HUMAN GEOGRAPHY

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HUMAN GEOGRAPHY

AN ATTEMPT AT A POSITIVE CLASSIFICATION
PRINCIPLES AND EXAMPLES

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By

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THE EDITORS' PREFACE

La Géographie humaine, by Jean Brunhes, gave us a new point of view in human geography, and a new method of analysis of an ever-appealing phase of geography. To make the new outlook available to students in normal schools and colleges and to the general reader has been the purpose of the editors in preparing the American edition.

This work was necessarily interrupted by war conditions, and the volume was delayed far beyond the time originally planned.

To meet the needs of American conditions, certain sections and chapters have been omitted, and, at the request of the author, the regional description of the Central Andes has been substituted for chapter vii in the original. In addition, the footnotes have been reduced in number and restricted to sources available in a good geographical reference library. Illustrations, footnotes, and text have been added to bring out significant and pertinent American facts in human geography.

Otherwise the original text has been followed faithfully. Professor LeCompte has aimed not merely to translate the idea but the exact shade of meaning contained in each part of the original. In case of doubt the editors coöperated in a personal discussion of the linguistic or geographical point, in order that the rendering into English might be faithful and smooth.

In the revision of the proofs, regional references have been changed where necessary according to the latest information available.

Isaiah Bowman
Richard Elwood Dodge

FROM THE PREFACE TO THE FIRST EDITION

Human geography is not completed. It is known that much remains to be done. This book is therefore not a "treatise," properly speaking (that term would undoubtedly be too presumptuous); it is rather a "manual" giving essential directions.

After having tried, in my various works on irrigation, to pursue the examination of a single class of geographic, economic, and social

problems in a small number of natural provinces capable of comparison, I now try to bring together and make apparent what is the ensemble of the various problems under the jurisdiction of human geography. . . . .

For the benefit of old students and beginners I have adopted this didactic form, which seemed to me the more legitimate since human geography is still in its beginnings, and so cannot always avoid the risk of being somewhat disordered.

Besides, geographers ought never to forget the increasing importance that is being given to geography in secondary and primary instruction. I hope that many of the pages of this book will help convince those whose duty it is to instruct the children of the people even in the smallest towns and in the rural districts to what extent the observation of the simplest human facts can give material for ingenious and rational exercises of analysis.

I have made it a rule to adhere strictly to essential principles. But I have not wished to treat of *principles* without considering the application of those principles. Frequent *examples* are therefore given throughout. All these examples here are only the means of illustrating the principles, in conformity with the tenets of all positive education. These are purposely unequally developed: they are like pictures at different stages of completion; by that means is revealed still better, it seems to me, the method of work and, as painters say, the "manner."

To conduct researches in human geography, the "geometric spirit" is indispensable; but is it sufficient? If possible, is there not also necessary a certain "spirit of finesse"? And in presenting the results, in giving a grasp of the meaning and the beauty of the entire network of points and lines, of the checkered rows of those little spots of different colors, dimensions, and unequal forms, which are the traces and imprints by which the ingenious activity of our kind has transcribed itself on the outer surface of our planet, who would dare pretend that a little art is sometimes not necessary? The dimensions must be measured, but the color also must be interpreted and the form brought out.

Almost all the detailed data in this volume are original and are based upon the direct observations of my pupils or myself. As to the illustrative material, I have made an effort to keep it equally original. It is not overdone. It is distributed more or less

abundantly according to the nature of the chapters and paragraphs. It is, as is fitting, strictly adapted to the text and commanded by it. . . . .

I desire to express my thanks in particular to my colleague and friend M. Paul Girardin, professor at the University of Fribourg, for all the suggestions and ideas I owe to long discussions on the subject with him. I thank my colleague M. Früh, of the University of Zurich, for the advice and complementary information which he furnished me, notably regarding various selections or cartographic examples.

That many analytic studies yet remain to be made before the difficult and definitive syntheses can be attempted is one of the conclusions that we hope will be drawn from the reading of these pages. First, one must try to classify the facts of human geography and to classify them according to the rules of observational sciences. By their very nature, these facts, unceasingly renewed and of an endless diversity, escape a classification that is too simplified and too artificial. Again, it is well to arrange the facts in series with clearness and exactitude, that it may not be necessary afterward to show how and why these groups of facts are far from being separated by impassable barriers.

There can be no question of making a complete bibliography of so vast a subject. Several volumes would not have sufficed. The abundant footnotes in the chapters will prove, it seems to me, that I have always been strictly careful to render earlier authors due justice. I have limited myself, otherwise, to bibliographical references which might be useful to readers for their personal instruction and to those which were indispensable as a justification for the assertions advanced.

FRIBOURG
November 1, 1910

FROM THE PREFACE TO THE SECOND EDITION

The first edition of the *Human Geography* was exhausted in a few months, and sufficient time has not elapsed between the two editions to bring about any great change in my thought and text.

There are persons who make books with the books of others! This one and that have congratulated me, but others have reproached

me for having given the principal place to my personal observations and those of my pupils. I am certainly far from disdaining—on the contrary, I admire with much reason—the works of our masters and predecessors; what has been called my erudition is proof of it. But I fear to say too much or too little when I take the risk of commenting upon and explaining what others have seen; since I do not pretend to limit myself to description, and as I try to take note of the facts themselves as well as the relations between the facts, I do not feel at ease unless I describe what I have seen.

The book in its entirety is a reaction against the metaphysical phraseology, mystical or political, which has so long pervaded the geographic works of certain countries: earth harmonies, superior rights of this or that race, or this or that empire, discussion of the "stages" of "instinctive culture" and "animal culture," of "instinctive culture" and "reasoned culture," etc. Let us not encumber ourselves in geography with such theses, with such analyses, with such arguments. They belong to other branches of learning or . . . . other interests. Our effort in the domain of a positive science has been rigorously subordinated to the positive method.

Of the many who have wished to read my book with conscientious attention, to discuss it with a very friendly sympathy, and to give it a well-analyzed review, I wish to mention particularly a Russian and an Englishman, A. Wocikof, professor of geography at the University of Petrograd, and George G. Chisholm, M.A., B.Sc. (Edin.), lecturer on geography, University of Edinburgh.

I wish also to mention and to quote Paul Mantoux for the following reasons: He is a man who is known by his works, but whom one has never known personally or with whom one has never been permitted the privilege, through conversation and discussion, of bringing out the subtle fine points, who takes your book, reads it through, grasps its true aim, and expresses carefully and clearly the impression he has received.

When an author tries to explain or defend his ideas, one can always reply: That is perhaps what you have thought, but it is not what you have written.

The article by Paul Mantoux appeared under the title "La Géographie humaine d'après Jean Brunhes," in the *Athena* of July, 1911,

a publication under the direction of Dick May and organ of the Ecole des Hautes Etudes Sociales. What is of especial interest in his review, needless to say, is not the too complimentary expressions, but it is the argument in defense of the method, admirably prepared, not by him who conceived it, but by one of those who, without taking sides, have wished to make themselves understand it.

The expression "human geography" is new to many readers. M. Brunhes begins by defining it. The object of human geography is the study of the relations between human activity and the phenomena of physical geography. The structure of the soil, climate, circulation of waters, vegetation, and animal life on the one hand, human establishments, ways of travel, cultivation, breeding, exploitation of natural resources on the other, are united by bonds of causality more or less apparent, by connections more or less close, which it is desired to search out and to throw light upon. M. Brunhes does not pretend to give us the definite results of such research, which is scarcely begun, but, on the contrary, to present problems, indicate methods, while multiplying useful references: in short, to open up systematically that vast, almost unexplored domain which gives promise of such significant discoveries. That is the purpose of the book, of a legitimate and restrained ambition. How has it been carried out, and what ought we think of it?

The first care of M. Brunhes has been to forestall the objections of those to whom physical geography is geography in its entirety, and who from the moment that one ceases measuring the height of a fault, or registering thermometric observations, would be inclined to cry literature. He has desired to give to the study which he extols a basis as objective as possible. It is thus that he has been led, not as he has been reproached, to banish from human geography the man himself, but to hold himself exclusively to the human phenomena which inscribe themselves on the soil, and which modify nature at the same time that they are modified or brought about by nature. A type of house, of city, the distribution of a cultivation, these are visible and material: these can and should be self-explanatory, just as well as the folding of a sedimentary deposit or the retrogressive erosion of a stream of water.

These phenomena of human activity, which leave an impression on the face of the earth, M. Brunhes divides into three groups, of which each comprises two subdivisions. These are, first, the "facts of unproductive occupation of the soil": man constructs habitations, man traces roads: houses and agglomeration of houses; roads of all kinds, from the path to the road of steel, must adapt themselves to geographic conditions. Then come the "facts of vegetable and animal conquest": cultivations and breeding, which man undoubtedly selects and directs, which he imposes in some sort upon

nature, but not without the consent of nature. Finally come the "facts of destructive economy," *Raubwirtschaft*, according to the expressive German term, which M. Brunhes usually quotes: animal and vegetable devastation, mineral exploitations having this common characteristic, that they take riches from the earth without giving anything in exchange. These are the *six essential facts*, to which reverts, according to M. Brunhes, all the material of human geography. He leaves to anthropology the study of the races, to ethnography the study of manners and customs. Why? Because the relation of man to his geographic environment is here less apparent, because it can provide in every case only partial explanations and very insufficient facts. Geography can lend its aid to the work of the biologist or the doctor, as to that of the sociologist or the historian: it ought not to confound itself with them.

In each of the three chapters which he devotes to the *six essential facts* M. Brunhes, faithful to the thought which guides him, makes no attempt to exhaust his material. He limits himself to outlining it, to tracing its logical divisions, to examples, to quotations, to which his reader could refer. When he makes a study of the house and its form, so often modeled by geographic forces, he takes two or three types which he has himself studied close at hand: the wooden house of forested Europe, that of Switzerland in which he lives, the house of earth and the house of stone in Egypt, which he visited and carefully inspected when he was preparing his works on irrigation. Having reserved to himself the right to eliminate and select, he refers preferably to that of which he has direct knowledge. Most of the illustrations which accompany his descriptions or his demonstrations, and which so happily illuminate the text, he has taken himself. He makes use usually of work carried on under his direction or in his immediate neighborhood, summing up, for the profit of everybody, the experience of the hard-working group that surrounds him. Thus, the study of the most general of facts takes on an original and personal aspect: the exposition of the method is illustrated, at each instant, by examples drawn from its application.

It is in that spirit that, after having finished the survey and careful distinguishing of the different parts of his subject, M. Brunhes has wished to see them all at once, mingled in complex wholes, like those which can readily be seen and experienced. But it was necessary that these wholes should be clearly delimited and be relatively simple, in order to lend themselves to a true methodical study in the present status of a science that is still in its beginnings. That is why M. Brunhes has chosen, in order to prepare monographs on them, small natural unities, veritable human islands: the island of the desert, represented by two examples, the oases of the Suf and the oases of the Mzab; and the island of the high mountain represented by an alpine valley, the valley of Anniviers [for which is substituted in the English

Can we make his few digressions a crime? Can we say that he errs in morality when he speaks as he does of the native woman in the colonized countries, or in his descriptive literature when he paints the gloomy life of the mines? Would one deny the master the right to remain a man?

This little laborious group which he has succeeded in gathering around him—is it not his influence as much as his teaching that has formed it? He retains his accent when writing, in the same way that he makes use of his work, of pictures that he has taken during his travels. I see the advantages of that style; I do not see the inconveniences. This book would not gain much by a more impersonal style. And it would run the risk of losing that which makes its *raison d'être*. It is not the abstract exposition of a completed science, but rather the program of his hopes, accompanied by a constant invitation to reflection and work.

Not only is human geography not a completed science, but is it, will it be, a science? To answer such a question it would be necessary to know what is meant by the word science. M. Brunhes is not of those who believe that they can reduce the most complex phenomena to rigorous laws and mathematical formulas. He admits that the chain of causes and effects, in the domain of human geography, is not always comprehensible, and that it is necessary to substitute more supple and less certain modes of explanation. "Between the facts of the physical order, there are sometimes relations of causality; between facts of human geography, there are usually only relations of connection. To force, so to speak, the bond which connects phenomena with each other is scientifically false." . . . .

What useful information to all those who are studying the collective phenomena of humanity! Between nature and human establishments is introduced an intermediary of which it is well to take account, the psychological element: "By what slender and subtle psychological threads is all that which we have called 'social geography' and 'historical geography' connected with the essential data of human geography! That is why we cannot too often repeat the constant appeals for restraint and critical prudence which we have already made. The geographical spirit, once more, could not do without a 'spirit of finesse.'"

Science or not—after all what matters the word? Human geography is an order of methodical investigation of which the object is from the present sufficiently determined, though the limits may have to be more or less advanced or withdrawn. Is not a true science the science in which at first we must feel our way, and which is formed by a succession of experiences? It is his experience which M. Brunhes brings to his readers and which he invites them to imitate.

I could never have better expressed, in a few words, my ideas, my aim, my plan.

I wish, finally, to thank the Geographical Society of Paris for having awarded to *Human Geography* its gold medal for 1911, and the French Academy for having granted it one of its prizes. . . . .

JEAN BRUNHES

FRIBOURG
March 15, 1912

HUMAN GEOGRAPHY

CHAPTER I

WHAT IS HUMAN GEOGRAPHY?
GENERAL RELATIONS BETWEEN PHYSICAL AND HUMAN GEOGRAPHY

1. *The real scope of geography. Physical and human geography.*
2. *The principle of activity: geographical facts, whether physical or human, are in a state of perpetual transformation.*
3. *The principle of relationship: the facts of geography are closely bound together and must be studied in their manifold relations and connections. The idea of the "terrestrial whole."*

I. THE REAL SCOPE OF GEOGRAPHY. PHYSICAL AND HUMAN GEOGRAPHY

The field of geographical study consists of a double zone: the lower zone of the atmosphere surrounding our earth, and the superficial zone of the solid crust. At all points where these two concentric zones come in contact we find produced three groups of basal phenomena.

A. The solar heat on our earth is the necessary condition of all activity and of all life. Its greatest effects are felt in the zone of contact where the atmosphere and the earth's crust meet. It is to the lower layers of the atmosphere (because these are more heavily charged with water vapor), and still more to the outermost "skin" of the earth, that the solar heat is almost exclusively communicated. Moreover, the greater part of this heat penetrates but a few feet into the soil and remains there but a few hours; it again passes from the soil to the atmosphere. In short, it rebounds, so to speak, from the solid or liquid surface of our planet, and thus reaches the lower portions of the atmosphere. The "heating surface" of our atmosphere is the surface of our own earth.

B. Again, it is in the zone of contact of the atmosphere with the earth's crust that the atmospheric phenomena — variations of temperature, rains, and winds — and especially the geographical facts which result from these — running waters and glaciers — are unceasingly at work to modify and destroy the projecting relief and to fill the submerged depths. The leveling of mountains, the development of river valleys, the filling up of oceans — all the facts which constitute the essential part of physical geography — are rigorously localized at the surface of the earth's crust.

C. Finally, it is on the surface of our globe and in the lower portions of the atmosphere that all the phenomena of plant, animal, and human life are concentrated. Even the birds which fly highest come to earth to rest or feed; the fish and the invertebrates of the deepest seas live, in comparison with the dimensions of the earth, at but a short distance from the surface. As for human beings, having their feet necessarily on the ground and drawing from the atmosphere the oxygen needed for their respiration, they express in the highest degree that imperious localization of life within two thin, concentric slices — a slice of rock or water and a slice of atmosphere — portions of the universe extremely small in comparison with the earth, and smaller still in comparison with known space, but portions favored above all others. There the sun concentrates its energy; there the atmospheric agents are constantly at work; there, finally, life, in all its diverse forms, develops and multiplies, indefatigably.

Now all these fundamental facts are not superimposed nor mingled in one "locality" without precise relations of cause and effect. We shall explain later (§ 2) the why and wherefore of these relations. In this introduction it is sufficient to point out how sharply circumscribed is the geographer's field of observation. Where all these phenomena are combined, and there alone, lies the field of geographical inquiry.

The greater number of these phenomena are in no way influenced by human activities. Whether man exists or not, water will still evaporate under the action of solar heat; and air charged with vapor, when driven against a mountain wall, will rise, expand, and cool, causing precipitation. Whether

man exists or not, running water will still carve valleys or wear away the brinks of waterfalls, and the land detritus borne along by the waters of streams will still tend, as soon as the force that carries it weakens, to spread out in alluvial cones or deltas. Whether man exists or not, the slow-moving glaciers will smooth their rough beds; the wind, bearing grains of sand, will sculpture the rocks of the deserts; the waves of the sea will cause the cliffs to crumble; and the whole surface of the earth, raised or submerged, will show changes due to the physical agents that have worked upon it. Such are the basal facts which form the essential foundation of all "physical geography."

A considerable part of plant and animal life also escapes the influence of man; the earth would be covered with vegetation and peopled with animals, even if man did not exist. Biological geography (plant and animal), part of which is often called "natural geography,"[1] is still often considered an aspect of physical geography understood in its most general sense.

But if we cast a general glance over the earth, we soon see a whole new and very extensive series of surface phenomena: here it is cities, there it is railroads; here it is cultivated fields, there it is quarries; here it is irrigating canals, there it is salt marshes; and in all lands are more or less dense masses or groups of human beings. These human beings are, in themselves and by themselves, surface facts and therefore geographical facts. They live *on* the earth. They are subject to atmospheric and terrestrial conditions. They belong to certain climates, to certain altitudes, to certain zones. Besides, they live *from* the earth: it is by subordinating themselves to natural phenomena that they assure to their bodies the necessary conditions for life and growth and to their faculties, development and expansion.

[1]The excellent *Bibliographie géographique annuelle* which is published in *Ann. de géog.* (Paris), under the direction of Louis Raveneau, includes meteorology, geology, orography, hydrography, and botanical and zoological geography under the general title of *Géographie naturelle*—the equivalent of what is here called physical geography. The *Physikalischer Atlas* of Berghaus (Gotha) includes among other volumes one entitled *Pflanzenverbreitung* and another entitled *Tierverbreitung*. These two sections of a special atlas of physical geography are, as the names indicate, devoted to the geographic distribution of plants and animals. The *Traité de géographie physique* by Emmanuel de Martonne (Paris, 1909; 2d edition, 1913) has a subtitle: *Climat, Hydrographie, Relief du sol, Biogéographie*, and in fact, a fifth of the volume is devoted to biogeography.

In biological geography human beings occupy an incomparable, a unique, place. They deserve from geographers special and careful attention, not only because of the reality of the covering which their living bodies form at certain places on the earth, but also because of their works. What are the ant-hills of our country or the mounds which the termites build in Australia, in Ceylon, in the Sudan, or in the Kalahari, in comparison with all that which is the peculiar work of man on our globe! In geography there is a striking difference — a difference for which there is no common measure — between the work of the animal species, even the best endowed and most ingenious, and the work of man.

Men reforest the mountains which have been stripped of their trees and thus moderate the destructive work of the streams and indirectly affect climate. They plant trees to hold the sands in place, and seaweed to fix the submarine mud: the trees keep the sands from being set in motion by the wind and the seaweed protects harbors from the capricious movements of the mud in estuaries.

Men do still more. Among the living beings they can arrange and control changes in the life-conditions about them; they "cultivate" plants and they "domesticate" animals; they labor unceasingly in order to make both more adapted to their needs. Within recent times, for example, they have crossed the English horse with the Arabian, and have obtained an equine type that possesses wonderful resistance, a type that is capable of enduring not only the climate of Great Britain, but also the varied climates of America and Australia.

The *ensemble* of all these facts in which human activity has a part forms a truly special group of surface phenomena — a complex group of facts infinitely variable and varied, always contained within the limits of physical geography, but having always the easily discernible characteristic of being related more or less directly to man. To the study of this specific group of geographical phenomena we give the name "human geography."

This appellation, thus understood, can give rise neither to ambiguity nor to any serious opposition.

2. THE PRINCIPLE OF ACTIVITY: GEOGRAPHICAL FACTS, PHYSICAL OR HUMAN, ARE FACTS IN PERPETUAL TRANSFORMATION

Everything about us is undergoing transformation; everything is increasing or diminishing. Nothing is really motionless or unchanging. The level of the sea, the universal and traditional guiding mark for measuring altitudes, is a purely fictitious mean surface; the real mean surface is not the same for all oceans nor even for all points of the same ocean. The immense glacial expanses, which seem eternal in their fixity, are nevertheless moving with a slow and silent but powerful and continuous motion — powerful because it is continuous. The hardest rocks cannot escape disintegration by the atmosphere. The loftiest peaks will sooner or later be reduced to more moderate heights. Thus, even where the superficial testimony of our senses reveals to us only immobility and stability, we must recognize the fact of movement, change, activity.

What, then, are the forces which unceasingly transform the superficial regions of our globe?

A. The igneous center of the earth is a primary cause of activity. The interior forces express themselves either by very slow, almost imperceptible but lasting phenomena — elevations, adjustments, subsidings; or, on the other hand, by sudden, violent phenomena, by fits and starts — upheavals, foldings, fractures, sinkings, earthquakes, volcanic eruptions. The first go on so slowly that they are hardly perceptible to any one generation of men and we are tempted to neglect them. The second surprise us by their strange unexpectedness; hence we are tempted to exaggerate their importance, forgetting that they are both local and exceptional, limited in extent and in duration. In reality, both constitute only a restricted part of the present activity of the earth; both play a secondary rôle in comparison with the daily and unceasing changes which are taking place everywhere and which are due to the action of the sun.

B. Solar heat is in truth the principal and predominant energy that causes almost all the activity taking place on our earth. The sun constantly produces differences of temperature; these cause differences of weight and differences of pressure

of the air; thence arise numberless causes of instability; and instability determines movement.

The zones of the earth on which the sun's rays strike perpendicularly are warmed more than the rest of the globe; the layers of atmosphere in contact with these terrestrial zones share in the increased heating. From this double series of phenomena arises the permanent planetary wind system of our earth.

C. Here another series of forces intervenes which transforms, directs, and multiplies the atmospheric movements. The earth is not motionless in space — it has periodic movements which are constantly changing its position with reference to the sun. Instead of counterbalancing the disturbances continually arising from differences of temperature, the astronomic movements cause the sun continually to vary its terrestrial field of action. They constantly augment the slightest daily disturbances, and hence deserve to be considered a third cause of activity. However, these transforming forces only cause changes in the conditions of equilibrium on our globe. It is still the sun which furnishes the *energy* — it is the sun that is the primary cause of these transformations.

The differences of temperature and the differences of pressure, associated thus with the cosmic forces, give rise to winds and currents. And while the eolian forces in their own way shape certain portions of the earth's relief, the atmospheric currents, acting upon the surface waters, cause to a certain degree the marine currents.

Above all, the air is a transporter of water vapor. As it becomes heated it can absorb an ever-larger quantity of vapor; but as it cools, its power of absorption diminishes and the water vapor is precipitated. Variations of temperature cause perpetual movements of the air, and these movements themselves modify temperature. The water, carried by the air in the form of vapor, shares in this incessant play; it undergoes, in turn, changes of place which determine changes of condition, and changes of condition which bring about changes of place. This interplay of the reciprocal effects of temperature and movement goes on indefinitely. Through the agency of this universal circulation, water is carried

by the air even to those parts of the continents most distant from the sea. The smallest drop moves and acts. Here, glaciers are formed; there, running waters unite in streams. Glaciers and running waters produce mechanical changes the effects of which are beyond appreciation, and of these mechanical changes the initial cause is still the sun.

Light and heat, rains, climates, and seasons — we owe them all to the sun. Let us go still further: it is on the sun that all life, plant and animal, depends; even the activity of the human body itself depends upon that energy which the sun dispenses in the form of heat. Nor is that all. The sun has created on the earth reserves of force, as it were, from which man may draw at will. It has stored up in coal an incomparable amount of chemical energy — "bottled sunlight" — which we may set free and utilize as we please; for coal is only the precious remains of an earlier luxuriant vegetation.

D. On the terrestrial globe the energy of the sun is, then, an endless cause of variation, or better, of unstable equilibrium and consequently of movement. But this movement would be irregular, the effects of this energy would be chaotic, if there did not exist, to combat this incessant cause of disorder, a general cause of order, a directing and organizing principle. This force, which might be called the wise force of the earth in contrast with the mad force of the sun, is the centripetal attraction of gravity. Among the multitude of chance groupings, of unstable complications, to which this continual and universal agitation gives rise, this powerful centripetal attraction imposes upon bodies of different weights, of different densities, one order of stability, one mode of equilibrium — that is, the order and mode of the superposition of the lighter layers and masses upon the heavier. A unified and regular result finally comes from this ever-renewed struggle between an indefatigable and universal cause of activity and an inviolable and universal cause of order.

This attraction of the heavier bodies toward the center of the earth disciplines and organizes activity; a harmonious order is thus introduced into the general economy of our earth. Our minds find a unity in the midst of the complexity of the phenomena. We begin by perceiving mechanical

phenomena side by side; then we see that these phenomena are really subordinate one to the other; finally we discover a principle that gives unity; we can legitimately arrive at the idea of relation, and strive to define laws. Instead of limiting ourselves to the simple observation of phenomena, we are led to study them in series and to seek the very principle of their succession. Every succession has causes and laws. The material phenomena thus acquire a sort of personal life — they have no longer merely minima and maxima, but a birth, a maturity, a decay; and we arrive at a conception of an organic development, as it were, of the physical facts, and establish a law of evolution even of the material forms of the earth.

This is one of the newest and most interesting parts of geography. Three quarters of a century ago we gave up classifying mountains according to their secondary or accidental characteristics, such as their direction or their altitude. We recognized that their formation dated back to different periods of the earth's history, and for the first time the notion of age was introduced into orography. But even then it was still a question only of relative age. Mountain systems, by comparison, were either more ancient or more recent; geologists and geographers dared go no farther.[1]

In a group of houses one can, from the style or by the aid of documents, decide which are the more ancient, which were more recently built; but we do not claim that these houses necessarily show the characteristic architecture of their age. We can, if we please, construct a building in Renaissance style, but, as soon as the stone has lost its brightness and freshness, our building will and must appear more ancient than a house of modern style. From material things let us pass to living beings and we shall at once be struck by the difference. No one of us would expect to find a child with the face of an old man, nor an old man with the face of a child. There are, of course, exceptional cases; but the exceptions themselves never go beyond certain limits. We affirm — and our affirmation has a universal import —

[1]Recently orogenic theories have been further developed: Suess, *Das Antlitz der Erde*, translated into French by Emmanuel de Margerie and published under the title *La Face de la terre*. An English edition by Sollas is entitled *The Face of the Earth*.

that each age has its characteristic features. Why? Because the development of the living being is of necessity subject to the laws of growth.

Now let us come back to our mountain systems and we shall understand what a change there has been in the ideas associated with age, under the influence of the new geographical ideas. Mountains are no longer merely structures of different dates and origin; in their evolution they are comparable to living organisms. They are no longer young or old with reference to each other — they are young or old with reference to their past forms and to their future forms. Age in orography is expressed by a topographical appearance. No continental mass can escape erosion, the progress of which is inevitable. The existing stage of erosion allows us to give the present topography a definite place in the necessary series of successive stages. It goes without saying that, for phenomena the regular succession of which demands thousands of centuries, the apparent exceptions are much more numerous and striking than for living organisms whose evolution is accomplished in less than a hundred years.

Then, too, the outcroppings of the earth's crust are not homogeneous in character; they consist of rocks of unequal hardness and of unequal resistance. But, whatever be the number of abnormal cases, and whatever be the importance of the accidental differences, we have none the less the right to speak, in the full sense of the word, of the *age of topographical forms*. And the idea is still more felicitous than the word. All mountains pass through successive stages of development; the different stages are represented by different surface features. It follows that a large number of existing mountains can be referred to a common type. Orographic systems, formerly regarded as having no similarity whatever, are thus connected in a common family; they show this common type at different stages of its evolution.[1]

In regions of recent folding, young mountains arise with steep and rugged forms; their birth is of too recent date for

[1]For the development of these ideas and the works on which they are based, consult A. Philippson, "Die Morphologie der Erdoberfläche in dem letzen Jahrzehnt, 1885–1894," *Geog. Zeitschr.*, 1896, pp. 512–527, 557–576, and 688–704; W. M. Davis and G. Braun, *Grundzüge der Physiogeographie*, Teubner, Leipzig and Berlin, 1911.

their modeling to be far advanced. Old mountains, on the contrary, have a softened relief; they have been leveled by erosive agents. Thus, we establish a relationship between the forms of the Alps, mountains which are still very young, and the aged forms of the plateau of the Ardennes or of New England. In the last two cases time has done its work—old age has come. The Alps likewise will doubtless some day in their turn be a slightly undulating plateau; they will finally become what we call a *peneplain.*

The geographer strives thus to group and classify all the types that he observes. He forms, for example, a common family of all the glaciated countries, and, because their surface features have had a common origin, he puts into this family Canada, Finland, Scandinavia, Scotland, and other countries which long ago were freed from their continental icecaps, and ice-covered Greenland, which has been aptly called one of their "backward brothers."

He who speaks of the age of topographical forms must also speak of the age of water courses. Rivers, like mountains, are more or less aged; all pass through different stages of which the succession forms a cycle, the cycle of erosion, which Davis calls the *life-cycle.*[1] They pass from infancy, which is distinguished both by an indefinite drainage system and by rapid streams, to old age, which is characterized by wanderings and bifurcations of every sort. During maturity the river flows in a well-defined bed, which it has itself excavated, and the slope is such that the water is easily and regularly conducted to the mouth. These stages, of course, pass into each other by imperceptible gradations. A river that is still young, like the Rhone, must pass through numberless stages (which it is as difficult to specify exactly as it would be to number) before resembling a very old river like the Mississippi or the Amazon. Finally, a river that has already reached old age may suddenly, as the result of the lowering or displacement of its base-level, begin its work of deepening all over again

[1]All these ideas are presented with clearness in A. de Lapparent, *Leçons de géographie physique*; see in particular Lesson VIII and Lesson X. See also W. M. Davis, "Rivers and Valleys of Pennsylvania," *Nat. Geog. Mag.*, I, 1889, pp. 183–254; *Practical Exercises in Physical Geography*, Ginn and Co., Boston, 1908; *Geographical Essays*, Ginn and Co., Boston, 1909; Emmanuel de Martonne, *Traité de géographie physique*, Paris, 1913.

in the opposite direction. It will thus again display the vigor of its early years, though retaining to a certain degree some of the forms of the earlier cycle. The river that had been growing increasingly heavy and slow, as if in a long sleep, can suddenly reawaken, but without putting off entirely the "old man." Thus it is that in a *thalweg* of a slightly undulating country of softened relief, where one would expect to see the feeble flow of a slowly-moving stream, one may sometimes discover a river, intrenched in a new channel, robust and active.

With all the more reason, therefore, is it permissible to compare with living beings series or groups of geographical facts of higher complexity — that is, geographical facts which concern the living beings themselves. Every day we make such comparisons. We say that the flora or the fauna of a country is growing young or old; and when they are being transformed, we say again that they are becoming enriched or impoverished. The population of a region or the development of an urban center is marked by successions of changes which resemble the characteristic phenomena of beings endowed with life.

And we must, above all, investigate the causes to which these phenomena owe their origin, and whether the point at which they have arrived indicates maturity or heralds decay. What matters it whether a city have 50,000 or 52,000 inhabitants? That is not the important question. What is the past of this city and what is its true age? At what point in its evolution is it? Has it reached or passed the flower of its maturity? Such are the problems to be set and to be answered. Is it an ancient city which formerly counted 300,000 inhabitants and which to-day has not more than 50,000? Is it a Ravenna or an Aigues-Mortes? Or is it, on the contrary, a very young city, born yesterday, in full tide of growth and destined to grow still more, like Pasadena or Seattle, or like those cities of South Africa, some of which after only twenty-five years of existence had reached a population of more than 200,000 inhabitants?[1]

[1]The town of Johannesburg, which was established September 20, 1886, had 102,078 inhabitants according to the census of July 15, 1896, and a population of 237,104 by the census of 1911. Winnipeg, Manitoba, with a population of 7,985 in 1881, had grown ten years later to 25,642 and to 163,000 by 1916.

What more striking than the march of Paris, as it can be approximately established from historical documents![1]

Years	Historic Periods	Number of Inhabitants (in thousands)
363	Under Julian	8
510	Under Clovis	30
1220	Under Philip Augustus	120
1328	Under Philip VI	250
1596	Under Henry IV	230
1675	Under Louis XIV	540
1788	Under Louis XVI	599
1801	Under the Consulate	548
1817	Under Louis XVIII	714
1831	Under Louis Philippe	786
1851	Under the Republic	1,053
1856	Under Napoleon III	1,174
1861		1,696
1866		1,825
1872	(After the annexation of	1,794
1876	the suburbs within the	1,989
1886	circle of the fortifica-	2,345
1896	tions)	2,436
1906		2,763
1911		2,888

At the beginning of the twentieth century all Europe contained about 160 cities of more than 100,000 inhabitants, of which 55 exceeded 250,000. The cities of a half million numbered 23, and the cities of a million, 6. A. de Foville rightly concludes: "Present-day Europe thus supports more cities of five hundred thousand inhabitants and above than the Europe of a hundred years ago supported cities of a hundred thousand inhabitants."

Have we even a clear notion of the growth of the world's population during the last century? In Europe it has at least doubled. "There exist at present," says A. de Foville again, "1,500 millions of men. If each century were to double the number, there would be 3 billions about the year 2000, 6 billions about 2100, 12 billions about 2200, 24 billions about 2300. . . . . We have already reached the impossible. Let us go on, however. In a thousand years it would be the mad sum of nearly 2,000 billions of human beings that our planet would have to support and feed. . . . . And

[1]After A. de Foville, "Les Grandes Villes au XIX^e^ et au XX^e^ siècle," *Économiste français*, June 13, 1908, p. 877.

will some one say that we are looking too far ahead? But what is a thousand years in the history of the world? Thirty generations; the time from Hannibal to Charlemagne, or from Charlemagne to Napoleon."[1]

What differences, besides, between two masses of human beings numerically comparable, such as the 268,000 inhabitants which the census of 1911 gave to the whole department of Lot-et-Garonne, and the 261,000 of the city of Bordeaux according to the same census! Not only are these groups, in one case massed and in the other scattered, attached to the soil in a wholly different manner, but, what is still more important, 70 years earlier, in 1841, Lot-et-Garonne had 78,000 inhabitants *more*, while the city of Bordeaux had 162,000 *fewer*.

Retrogression and progression: These human phenomena, like all terrestrial phenomena, never remain stationary; we must study them in evolution, catching them on the march and seizing them, so to speak, in full activity. They are animated by a definitely determined movement. We must study them as we study bodies in motion: we must determine definitely the point of space and the moment of time at which they are produced, then point out the direction and observe the speed of the movement itself. Such must be one of the dominant purposes of those who observe geographical facts, for progression is as true of human facts as of facts of the physical order.

Thus to put in the foreground the idea and the fact of activity will be to produce a real resurrection of the idea of life in a study particularly concerned with the present life of the earth.

3. THE PRINCIPLE OF RELATIONSHIP: THE FACTS OF GEOGRAPHICAL REALITY ARE CLOSELY BOUND TOGETHER AND MUST BE STUDIED IN THEIR MANIFOLD INTERRELATIONS. THE IDEA OF THE "TERRESTRIAL WHOLE"

It is not sufficient to study by themselves these different series of phenomena. In reality they are not isolated; they depend upon each other.

[1] A. de Foville, "L'Avenir des populations humaines," *Économiste français*, November 30, 1907, p. 768.

The evolution of water courses is related to the evolution of mountains, and vice versa. These two phenomena are so closely interrelated that in very truth they form but one study. The first course of a stream over a section of country is determined by the superficial conformation of the surface; but as the river develops, it modifies the relief of the region through which it flows. The liquid element removes the solid element; but the solid element directs and often stops the liquid element. The hydrographic systems and the basins of different water courses are thus associated in a common destiny. One may say that they make each other.

As a country ages under the attack of streams and weather, even its climate will be changed. The air will not have to rise so high to cross the subdued mountains; it will therefore undergo less expansion and be cooled less, and a smaller part of the contained water vapor will be precipitated. The influence of the climatic régime being thus transformed, its effects will be apparent upon the natural vegetation. Further, if the annual rainfall is diminished because of the modified relief, it follows that the flow of running water is diminished and the work of erosion will be slowed up. This in turn modifies the drainage by diminishing the precipitation. Finally, the water vapor which formerly was precipitated over this basin will be carried farther, to the benefit of another section of the earth's crust.[1]

Nothing shows more clearly than such examples the general interactions of phenomena, and nothing reveals more distinctly the importance of the idea of relationships in geography; this suggestive idea must dominate every complete study of geographical facts. One cannot be content with the observation of a fact by itself or of an isolated series of facts. After this initial observation, it is important to place the series back in its natural setting, in the complex *ensemble* of facts in the midst of which it was produced and developed. We must investigate the manner in which it is connected with the series of facts which are its neighbors; we must ascertain in what measure it has determined them, and in what

[1] J. B. Woodworth. "The Relation between Baseleveling and Organic Evolution," *Amer. Geol.*, XIV, pp. 209–235.

measure, on the other hand, it has been affected by their influence.

Of course, certain groups of facts were long ago observed and studied in their relations. Under the heading of *climate*, for example, a whole group of closely connected phenomena were brought together; but that was only an instinctive application of the principle of relationship. To-day this principle, clearly perceived, must be methodically introduced into geography as a whole.

In meteorology, in zoölogy, in botany, it is possible to isolate certain facts, to study them by themselves. In geography one cannot stop there. And the principle of relationship, the application of which is especially fruitful in geography, has penetrated even into these individual sciences. We have seen phytogeography created by the side of botany; zoögeography by the side of zoölogy. Now the end proposed in these new scientific branches is the study of the relationship of facts whose analytical study is the purpose of the mother branch.

Systematic botany collects and classifies plants, genus by genus, species by species; it also draws up catalogues and makes herbariums, country by country, province by province. We cannot dispense with this primary study; but it must be recognized that, even if the specimens are sought out, chosen, and examined with the most conscientious care, the region itself, as a natural vegetal region, may be somewhat neglected, as demonstrated by the importance given a rare plant though it be represented by only two or three individual specimens. Yet, when one looks at a picture one does not limit himself to counting the strokes of the brush and to classifying the tints; one must consider the harmonious whole produced by the mingling and opposing of the colors and shades. One can of course notice an isolated, peculiar touch of only secondary importance; but how can one neglect the impression produced by the picture as a whole? It is necessary to take account of those dominant color effects which, by their arrangement, give the key and, by their combination, determine the artistic impression and give character to the work.

It is the same with the vegetal carpet of a natural region

as with a picture. This carpet has dominant traits, a physiognomy. Likewise, for the geographer, the significance of the combination and relative value of the more abundant plants (vegetation) has an interest entirely different from that of the complete list of morphological types (flora). The vegetation reveals to a greater extent the general conditions of life and has a biological value besides. When we travel over the heath of Brittany, the purple foxgloves, the broom, all the vegetal carpet which we trample under foot, recall to us similar natural regions such as the heaths of Wales or of the Central Plateau of France. Any one group of plants acts, in fact, in the same manner with reference to the same group of connected natural causes — subsoil, light, humidity, etc. That is another reason why in every vegetal region we should try to see, above all, the main features, the large masses.

Such are the first principles of botanical geography. We are no longer interested in isolated individuals or floral species, but in groupings and in two main categories of groupings: the *plant formations* and the *plant associations*.

The *forms of vegetation*, or *plant formations* (*die Vegetationsformen*), include plants which, while very different from the morphological point of view, are similar in appearance and present themselves to us in similar attitudes. The most general of these classes correspond to empirical definitions; for example, trees, bushes, herbaceous plants, epiphytes — that is, plants which develop on other plants — etc. To make use of the expression often used by the true founder of botanical geography, Alexander von Humboldt,[1] these are properly "physiognomy" categories. We are already close to geographical reality. We may leave together plants which systematic classification separated and scattered, but which, however, are united and mingled in nature, such as those two species of rank plants which we find associated in dry regions: the aloes, with *succulent leaves*, and the cacti, with *succulent stalks* but without leaves. In the same way the larches, which lose their leaves at the end of autumn, conifers though they are, will fall in with the deciduous trees of northern regions. On the

[1] Von Humboldt is the author of *De distributione geographica plantarum secundum cœli temperiem et altitudinem montium*, Paris, 1817.

other hand, from this new point of view, the old divisions into species are broken up. The powerful and very abundant family of graminaceous plants, which includes the rice and the gigantic bamboos of tropical regions as well as the maize and the rye grass of temperate regions, is entirely dismembered, and the genera and species are distributed among several *forms of vegetation.*

The second unit of botanical geography has a yet greater value: it represents still more clearly the facts of natural connection. The plant world, we have said, gives to certain similar countries a like physiognomy: very different plants have, in fact, analogies of temperament, as well as affinities; the *ensemble* of the plants which live together and whose natural grouping is expressed to our eyes by a characteristic landscape, constitutes a *plant association* or *Pflanzenverein.*[1]

Thus the forests include many different associations, and if some are due to almost a single plant formation like the association of the littoral tropical forests (forests of mangroves), there enters almost always into any single association a large variety of formations. The great trees of our region, beeches and firs, develop into great *forests.* Each of them is accompanied by the same group of bushes, grasses, or mosses which gives to it everywhere the same underbrush. It is a sort of necessary retinue which shares its fortune, which is associated with its life; and all this living group is collectively designated by the tree or by the species which predominates, as *the fir association,* the *beech association,* etc.[2] Thus an entirely new botany has been created which gives more attention to the real grouping of living forms.[3]

[1]Warming, *Oecology of Plants: An Introduction to the Study of Plant-Communities* (English adaptation by Groom and Balfour), Clarendon Press, Oxford, 1909; F. E. Clements, *Plant Physiology and Ecology,* Henry Holt and Co., New York, 1907; Coulter, Barnes, and Cowles, *Textbook of Botany,* Vol. II, *Ecology,* American Book Co., New York, 1911.

[2]See Ch. Flahault, "Au Sujet de la carte botanique, forestière et agricole de France, et des moyens de l'exécuter," *Ann. de Géog.,* October 16, 1896, pp. 450–451; cf. also Warming, *op. cit.*; and Oscar Drude, *Handbuch der Pflanzengeographie,* Engelhorn, Stuttgart, 1890; geographers are directed also to the more recent work by R. Chodat, *Principes de botanique,* Paris and Geneva, 1911.

[3]These natural associations are so well established that botanists are enabled to reconstruct the ancient vegetal coverings of regions. "The dominant species of a primitive association having died out, other species belonging to the same association, characteristic forms accompanying the dominant species, live on, often unnoticed and neglected, but trustworthy evidences of the past and sure signs of the plant associations that once flourished there. Thus the botanist restores a country as the archaeologist restores the temple of Epidaurus or the Acropolis. He discovers forests of beeches under areas covered with myrtle: forests of cork-oaks and chestnuts under

We might, in addition, show manifold relationships between the same natural conditions, soil and climate, and the animal world; between the plant and the animal world—between the different types of the animal world.[1] But we need only note here this general necessary orientation in different kinds of investigation. In a work published in Germany, *Domestic Animals and Their Relations with the Economic Life of Man*, the author is not satisfied with studying domestic animals one by one, or with describing their organs, or with seeking their origin. He takes them in their geographical setting; he examines the relationships which exist between the animals and the cultivated plants, and determines with what methods of exploitation of the soil, with what sorts of cultivation, and even with what forms of economic organization they are generally associated.[2]

The study of the origin of the terrestrial faunae is becoming more and more geographical. If one consult such a well-known book as that of R. F. Scharf, on the faunae of Europe, one finds that the only two factors which are to-day introduced to explain the distribution of animal population are, first, the continental continuity (present or past), and, second, the intervention of man—factors which are both of a distinctly geographical character.[3]

Through these facts of plant and animal distribution, through these forms of economic organization, we come to

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the brush of Corsica. A few species surviving an association are our touchstone" (Ch. Flahaut, "Le Devoir des botanistes en matière de géographie humaine," *Compte rendu du IX^e Congrès géog. internat., Genève, 1908*, I, Geneva, 1909, p. 290). Further, botanical geography understood in this way furnishes a suggestive principle, both positive and critical, to paleobotany, or the study of the flora and vegetation of different geological periods: "In all of these investigations, consideration of the general character of the flora one is studying, of the climatic conditions in which it seems to have flourished, would naturally result in useful bases for interpretation; for example, that the presence of types belonging to warm regions would be unlikely in a setting of types belonging to cold ones, or vice versa. But that is a sort of argument that must be used with greater discretion the farther one gets from the present time, it being quite possible that species different from those of our era, however like they may be, did not have exactly the same needs" (R. Zeiller, "Les Problèmes et les méthodes de la paléobotanique," *Rev. du mois*, December 10, 1909, p. 654).

[1] Arnold Jacobi, *Tiergeographie* (Sammlung Göschen), Leipzig, 1904.

[2] See Eduard Hahn, *Die Haustiere und ihre Beziehungen zur Wirtschaft des Menschen. Eine geographische Skizze*, Leipzig, 1896. Cf. Maurice Caullery, "Animaux domestiques et plantes cultivées," *Ann. de géog.*, January 15, 1897, pp. 1–13; A. Hettner, "Die Haustiere und die menschlichen Wirtschaftsformen nach Eduard Hahn," *Geog. Zeitschr.*, March, 1897, pp. 160–166.

[3] More and more the tendency is to explain such facts as due to other causes than marine currents or migratory birds. See R. F. Scharf, *European Animals: Their Geological History and Geographical Distribution*, London, 1907.

man. Our endeavor finds its entire *raison d'être* in the great geographical principle of relationships. For men themselves, like the plants and the animals, are closely bound to a certain number of phenomena. Man has need of water both for himself and for the animals which live near him; he naturally fixes his dwelling about springs, and the distribution of springs often explains the distribution of groups of habitations. Compare the Champagne and the Morvan. In Champagne *pouilleuse* the soil is very permeable and springs are not numerous, though they have in general considerable volume; the houses and farms are therefore found huddled together in groups far from each other. In the Morvan, on the other hand, in nearly all localities slender threads of water gush out and flow; as a result the houses are isolated and scattered widely (Fig. 7). In Lorraine a line of springs follows the line of contact between the permeable lower oölite and the impermeable clay of the Lias; cities and villages are strung along this line.

At other times men grouped themselves on the border line of very dissimilar natural regions because this border line was a natural place of exchange. The pasture lands of volcanic Auvergne are bordered on the northeast by the rich agricultural plain of fertile Limagne, and are surrounded elsewhere by crystalline regions, poor lands covered with moors, and chestnut groves; the most influential cities are placed on the border of old volcanoes and form a belt which never leaves the geological boundary line (see Fig. 1).

A striking example of the geographical importance of a geological boundary line is found in the line of significant cities that have grown up at the Fall Line between the Piedmont Belt and the Coastal Plain in the eastern United States. Where the streams of the strong rock Piedmont pass by a series of small falls and rapids to the Coastal Plain area, they furnish power for manufacturing. The presence of the falls, at or near the head of navigation of the Coastal Plain streams, necessitated a change in the form of transportation. Cities situated at the falls drew their sustenance and goods for trade from two contrasted soil areas. The geological boundary still continues to be the basal cause of the important cities

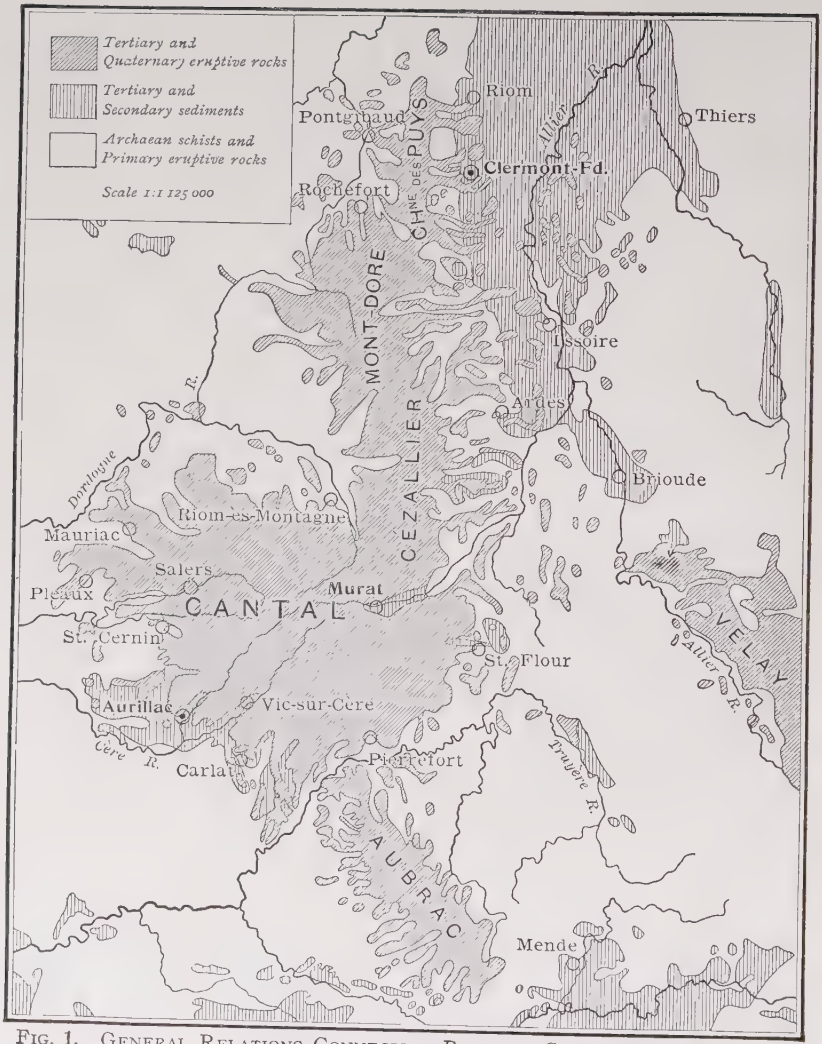

FIG. 1. GENERAL RELATIONS CONNECTING PHYSICAL GEOGRAPHY AND HUMAN GEOGRAPHY: THE DISTRIBUTION OF THE PRINCIPAL URBAN CENTERS ON THE BORDER OF THE VOLCANIC REGIONS OF CENTRAL FRANCE

It is most often at the point of contact between the eruptive areas and the quite different surrounding lands that small cities (Saint-Flour, Mauriac, Pleaux, etc.) are situated. Here the extremities of the ancient lava flows terminate and the base of the very poor Archaean soil appears. Clermont-Ferrand, Riom, Aurillac, etc., more important cities, are found where the eruptive rocks meet the richer soils of the great Oligocene basin of the Limagne or the small Aurillac basin.

From the 1:1,700,000 geological map accompanying the fine monograph (given the award by the Academy of Sciences) of Marcellin Boule, on the age of the last volcanos in central France, *La Geographie*, XIII, 1906, p. 179.

that are to-day found at the Fall Line from New Jersey to Alabama.

The importance which we attach to Quaternary glaciation [writes one geographer[1]] comes from the fact that in Savoy, as in high mountains elsewhere, physical geography and human geography are in greater part the work of the ancient glaciers. They it is that have at least broadened, deepened, and shaped the Alpine valleys; they it is that, after the erosion of the bordering rocks and the grinding of the harder elements in the complex of the deep moraines, have made habitable the mountains by leaving this erratic drift either in the depressions of the valley thus hollowed, or on the gentler slopes, or on the bottoms of the preglacial valleys. In fact, these erratic deposits, being impermeable (especially the glacial silt of the deep moraines), make, along the sides of the valleys, a line of springs at contact with which the water absorbed by the slope reappears, a characteristic which allows us to recognize them in the landscape. On the other hand, these *glacial banquettes*, as they are termed by W. Kilian, formed from material of different origin, include elements of every nature—calcite in a granite country, flint in a calcareous country—always very finely ground; these are cultivable soils *par excellence*, and often the only available ones of the valley. Hence they are selected for human habitations.

Löwl[2] had noticed previously that, in the tributary valleys of the Oetzthal, the greater part of the population lives on the alluvial cones; in the Langtaufererthal the figure amounts to 84 per cent, in the Valserthal to 94 per cent. In the high mountains we shall show that the population on moraines surpasses this.

These Quaternary moraines touch human geography still more closely. Lateral moraines, in particular, keep the slope of the ancient glacier, a slope hardly stronger than that of the valleys which they dominate, but weaker than that of the present glacier. They unite above with what remains of the ancient glacier, habitually in the form of hanging glaciers. Thus there are continuous projecting banks, fully prepared to conduct irrigating canals over the impermeable soil of the glacial mud. These canals, called *bialets* or *bialières*, ramify into the complex of frontal moraines, covering sometimes the entire bottom of a valley, such as the valley of Polset above Modane, or the valley of Chavières-sur-Pralognan. The proprietors of the chalets of Polset, at an altitude of 5,935 feet, have thus been able to utilize the multitude of small intersecting crests of the recessional moraines for the distribution of ditches in the form of a checkerboard; a more important canal leads to Villars, above the Praz; the same distribution is found in the

[1] Paul Girardin, "Glaciation quaternaire," *Rev. de géog. ann.*, II, 1908, pp. 691–692.

[2] "Siedlungsarten in den Hochalpen," *Forschungen zur deutschen Landes- und Volkskunde*, Vol. II, No. 6, 1888, pp. 408–409.

Paul Girardin

FIG. 2. CONNECTING RELATIONS BETWEEN PHYSICAL GEOGRAPHY AND HUMAN GEOGRAPHY: THE PART PLAYED BY GLACIAL DEPOSITS IN A HIGH VALLEY OF THE FRENCH ALPS

View of the chalets of Polset (valley of Polset, above Modane) at an altitude of 5,900 feet (1,800 meters). It is the highest group of chalets in this region. The pastures in the foreground are on a thick uneven mantle, representing the terminal moraines (Daun period) of the Chavières glacier, now reduced to the state of plateau-glacier. Every moraine-crest forms a slight ridge which interrupts the slope of the declivity, and carries an irrigation canal diverted from up the stream. The verdant area corresponds exactly with the irrigated, and the contrast between the meadow and the rubble (in the limestones of the Triassac) is particularly clear on the left. On the wooded eminence (7.175 feet or 2,193 meters) to the right are the last trees (upper limit of tree-growth).

Lavoir, south of Modane, and in the valley of Bonneval is the canal of Vallonet, which carried water to the mills or *mulinets*, situated near the falls of the torrent of Vallonet; these were the mills of the former town of Bonneval, buried, tradition tells us, beneath the Clapier de Fodan. Above Bonneval, again, a *bialet* not kept in repair comes from the glacier of the Fonds Valley and waters the Lenta and Grande Feiche; at Glière-de-Pralognan an abandoned canal follows in the same way the crest of the lateral moraine below the Morion. These last three canals, like many others in Savoy, are not kept up. They testify to the fact that here, as elsewhere, later generations are more grudging of time and trouble. What remains of these old canals suffices to show the bond which unites irrigation to the moraines of ancient glaciers.

Some relationships are of a still more delicate complexity. An eminent geologist thus formulates the relations between natural conditions and human life observable in the Armorican peninsula:

> The natural regions of Brittany show certain common characteristics; all are remarkably long and narrow, presenting a streaked structure in slender, parallel bands of different composition. . . . The inhabitants have had to adapt their lives to the structure of their soil, which is full of ridges with narrow furrows between them. Each of these grooves has been occupied by breeders who have found themselves shut in and self-sufficient, and not obliged to have dealings with their neighbors. Brittany has thus become, as a result of its climate and the structure of its soil, a country of *pasture-grounds not used in common*. Thus, it is against his neighbor's cow that the Breton peasant defends his property by planting around his patches of ground, walls of thorn-broom and girdling them with ditches like fortresses.[1]

The situation, the configuration, the structure, or the climate of a country helps to explain the historical development of a people as a social organization. As far as certain countries, such as England, are concerned, that is a current truth. But even for political facts which have long been considered somewhat surprising and abnormal, we can discover real natural foundations. Professor Theobald Fischer, in a very remarkable work on the Iberian Peninsula,[2] explains clearly why Portugal has been able to preserve her historical and political autonomy. Portugal is nothing more than a peripheral zone

[1] Charles Barrois, "Des Divisions géographiques de la Bretagne," *Ann. de géog.*, March 15, 1897, pp. 103–104.

[2] "Die iberische Halbinsel," in *Länderkunde von Europa*, edit. by A. Kirchhoff, Part 2, second half, pp. 519–754, Tempsky, Vienna, 1893.

such as the plains of Valencia or Andalusia, which border on all sides the central Spanish plateau; but Portugal alone is separated from Spain by the deep canyons of three great water courses and their affluents — a natural frontier more effectual than many mountain chains. In the second place, much more than any other region of the peninsula, Portugal is closely connected with the sea, and through her great estuaries the tide penetrates far into the land. And, finally, Portugal has lived a life of her own because, having the same products as certain other parts of the peninsula, she has had to turn away from Spain and toward the sea. Professor Fischer happily compares the geographical situation of Portugal, independent of Spain, to that of Holland, independent of Germany.

Do we wish examples still more simple, more decisive, and incontrovertible? Let us recall the attraction exercised over man from remotest antiquity by certain natural products; let us recall the commercial activity of which the spices of India alone have been the determining factor. Salt has played a greater rôle in history than has gold: how much trade it has brought about, how many regular exchanges it has established between far-off countries! In our times coal has been a prodigious creating and transforming cause. Farther on we shall have occasion to show in some detail to what extent it has attracted men and brought them together.

We may now see what part the investigation of causes may play in human geography. Human facts and natural phenomena cannot be separated.

This method, followed by the eminent geographer and teacher, P. Vidal de la Blache, is clearly set forth in the preface to his *Atlas:*

> The political map of the country to be studied is accompanied by a physical map; they throw light upon each other and find their complement in the maps, or diagrams, for which geology, climatology, the science of statistics, have furnished the subject. The collection of material, more or less complete according to the case, aims at placing before us the *ensemble* of the features which characterize a country, in order to allow the mind to establish relationships between them. In fact, it is in this relating of parts that the geographical *explanation* of a country consists. Considered by themselves, the features which compose the physiognomy of a country have the value of a fact; but they take on the value of a scientific idea only

when we put them back in the chain of which they form a part and which alone can give them their full significance.

Is the word *explanation*, which we use here, legitimate? Certainly we do not claim to give, in geography, the primary reason for everything which now exists or is being produced on the earth's surface; but to endeavor to connect the phenomena with each other, and thus to reduce the part that must be assigned to pure chance, is to *explain*.

In trying to show in this way a country under different aspects [P. Vidal de la Blache continues] I have had no other end in view than to emphasize the principle of relationship which unites geographical phenomena. I have had to borrow from neighboring sciences, not of course for the sake of focusing the attention on different subjects, but in order to draw from them useful proofs. I have not tried, for example, to elucidate the science of statistics by a set of selected maps, but rather to develop geography by means of statistics. I have not sought to imitate the scientist who follows step by step and figure by figure the evolution of an economic or social phenomenon, but only to establish from these figures the averages upon which geography may base a principle. Whether it be a question of climatic, botanical, or economic facts, it is the relation that I have sought to point out. Where certain phenomena of climate are localized, we find certain forms of vegetation, a certain distribution of crops—*that* is the geographic element, the element which allows us to grasp the relationship between climate, vegetation, and soil.

The *characteristic quality* of a country is thus a complex thing resulting from the delicate and varied interactions of many factors.

It follows that we must not restrict our study to a single order of phenomena. Even the least ambitious geographical study, to be complete, cannot be limited to mere observation of isolated facts; the earth's surface cannot be divided into isolated areas; there may be broad natural divisions, but there are no small closed fields. A single mountain does not form a whole; neither is a city an independent unit area, for it depends upon the soil on which it rests, upon the climate which plays upon it, upon the whole vast contributing area from which it draws its sustenance and life; nor is a river an individual thing which can be considered apart from the land through which it flows.

The great meteorological phenomena, such as the trade-winds, monsoons, cyclones, are striking manifestations of the close interdependence of the different parts of the earth.

Let us consider facts which are constantly to be seen right at hand. A great aërial current from the west brings damp and relatively warm air into parts of all western and even central Europe and constitutes one of the essential elements of European climates. If a cyclone has formed within this current, far from the European coast, over either the Atlantic Ocean or even on the coast of America, the result will be a storm which may eventually reach the shores of Europe. If it approaches Iceland, and shows its presence naturally by strong barometric depression, the English Channel is beaten by violent winds from the southwest, and the North Sea by winds from the south; rain falls in abundance over the British Isles and the coast of France. But suppose the whirling movement proceeds toward the Scandinavian Peninsula, instead of advancing to central Europe; the winds and rains over western Europe diminish and the barometer rises. Suppose, on the other hand, that the current bringing the barometric depression strikes Europe obliquely and passes from the North Sea to the Mediterranean; when the low-pressure center is over the Gulf of Lions the *mistral* is let loose in the Rhone Valley.

One might attempt to follow this storm into all its distant effects; but where could one stop? It is a center of influence without limit, which establishes relations more or less direct, more or less variable, more or less visible, but *always effective*, between countries that seem totally unrelated.

We thus reach the highest thought, the thought of the terrestrial whole—the conception of the terrestrial unity. The different forces do not act upon each other only under fixed conditions, nor do they exert a reciprocal action only in a few definite instances. The very opposite is true, for, in a manner more or less remote, in a form more or less discernible, all these forces are closely bound together because of the endless interrelations of the conditions they bring about.

'The idea that the earth is a unit, the parts of which are coördinated, furnishes geography with a working principle of method, the value of which is more evident as its application is extended."[1]

[1] P. Vidal de la Blache, "Le Principe de la géographie générale," *Ann. de géog.*, January 15, 1896, p. 129.

Activity and relationship: these then are the two principles which to-day must dominate geography.

The forces of physical nature are bound to each other in their consequences, in their relations, and in the consequences of these relations. Man does not escape the common law; his activity is included in the network of terrestrial phenomena. But, if human activity is thus circumscribed, it does not follow that it is fatally determined. Because of its connection with natural phenomena it is, without question, included in geography in two ways: it responds to the influences of certain facts and, on the other hand, it exercises its influence on other facts. For this double reason it belongs to geography. That is why we must add to the group of material forces, whose incessant interplay we have seen, this new force — human activity — which is not only a material thing but which also expresses itself through material effects. That is why, as geographers, we are led to study man's part in nature — without ever separating it from the study of physical geography.

CHAPTER II

HOW ARE THE FACTS OF HUMAN GEOGRAPHY TO BE GROUPED AND CLASSIFIED?

1. *The antecedents and beginnings of human geography. The orientation given by Ratzel.*
2. *The facts of human geography classified according to their increasing complexity. From the geography of the first vital necessities (fundamental physiological needs: eating, sleeping, clothing, defense) to political and historical geography.*
3. *An attempt at a positive classification. The three groups and the six types of fundamental facts. The small natural units: the "isles" of the sea, of the desert, of the forest, of the high mountain, and of the plains.*
4. *The natural forces. Water and wind. Human beings. The first maps: rainfall and population maps.*

I. THE ANTECEDENTS AND THE BEGINNINGS OF HUMAN GEOGRAPHY. THE ORIENTATION GIVEN BY RATZEL

Modern geography aims at the comparison and classification of phenomena, and at their explanation in the widest sense of the word. The geography of yesterday was defined as the *description of the earth;* by contrast the new geography is really the *science of the earth.*[1] It does not content itself with merely

[1]Geography is the science of the earth as it is to-day, while geology deals with the earth's past. These two sciences come in contact but are not merged. H. J. Mackinder, in comparing and contrasting the new points of view and methods of geology and geography, has said very truthfully that geology is the study of the past in the light of the present. But this general definition cannot be understood literally as the chief difference between geology and physical geography. On this point we cannot do better than refer to the thoughtful remarks with which Sir Archibald Geikie, the eminent English geologist, summarized and closed an instructive discussion at Nottingham on September 15, 1893, between Sections C (geology) and E (geography) of the British Association for the Advancement of Science. For a complete account, see "The Limits between Geology and Physical Geography," *Geog. Jour.*, December, 1893, pp. 518–534. The same number contains an interesting discussion concerning "The Present Standpoint of Geography," presented November 13, 1893, to the Royal Geographical Society of London, by its president, Sir Clements R. Markham. All this is less excluding than the statement in 1883 by the eminent geographer, F. von Richthofen, in his *Aufgaben und Methoden der heutigen Geographie*, a statement, which doubtless he would not have made in the same form later: "The surest basis for geography is geology *in ihrem ganzen Umfang.*" Geology is no longer the only indispensable foundation for geography, and geologists are to-day the first to recognize it.

describing the phenomena — it explains them. It studies the development of the different forces which act upon the earth, their processes, and their consequences. In the second place, it studies these different forces in their relation to each other, and the consequences of these relations. As has already been stated, scientific geography — modern geography — is dominated by two leading ideas: the idea of *activity* on the one hand and the idea of *relationship* on the other. It is no longer an inventory, it is a history. It is no longer an enumeration, it is a system. It has the double purpose of observing, classifying, and explaining the direct effects of the acting forces and the complex effects of these forces working together.

For centuries two conceptions of geography have been opposed to each other; by generalizing and perhaps stretching the facts a bit, one might be called the Greek conception, the other the Roman conception. The Greek conception was loftier and truer. The Greek geographers, Thales of Miletus, Eratosthenes, Hippocrates, and Aristotle, were philosophers; they had a general, philosophic conception of the physical universe and they sought *before everything else* to work out the natural succession of phenomena and how these phenomena were subordinated to each other. Then came the Romans with their utilitarian spirit; their geography was *practical.* They established itineraries, and composed topographical dictionaries; they were especially dominated by commercial interests, by administrative problems, or by ambitions of conquest.[1] From that time general and speculative geography was neglected; the spirit of geographical science and the taste for it were lost. Only a few men, as rare as they were farseeing, strove to preserve the scientific point of view in geography.

Long after the marvelous period of the great discoveries (1492–1523: Christopher Columbus, Vasco da Gama, Magellan) Bernhard Varenius, by publishing (in the first half of the seventeenth century) his *Geographia Generalis,*

[1]Strabo, who was the first to develop regional or descriptive geography, and Ptolemy, who represented a reaction in favor of general geography, were the leading geographers of the Roman period; but neither of them was a Roman and they both wrote in Greek. See the volume on Strabo by Marcel Dubois.

really inaugurated modern geography.[1] But we must come down to the nineteenth century to see in Europe the true renaissance of geography. At the beginning of the last century two men, whose work was complementary, set forth the guiding conceptions both of that part of the science which was to become physical geography and of that part which was to become human geography. One was the great scientist, Alexander von Humboldt (1769–1859), the author of the *Cosmos;* the other was Karl Ritter (1779–1859), the author of the *Allgemeine vergleichende Erdkunde*, who, more historian and philosopher than scientist, was always dominated by teleological ideas which, in spite of certain exaggerations, led him to seek everywhere the affinities and relationships between man and the earth. To these two great names joint homage must be paid at the beginning of every modern attempt to fix the method of geographical study.[2]

In France the renaissance had been slow. Before that profound and penetrating transformation to which the name of Vidal de la Blache will always remain particularly attached, our teaching for a long time had been faithful to an unfortunate routine. Children and young people were taught geography in manuals without illustrations and without maps; atlases were for them unknown and sometimes even forbidden books.[3]

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[1]See G. Günther, "Varenius," *Klassiker der Naturwissenschaften*, Bd. IV, Theod. Thomas, Leipzig; and M. Kiessling, "Varenius und Eratostenes," *Geog. Zeitschr.*, XV, 1909, pp. 12–28.

[2]If one should write a complete history of geography, and especially German geography, it would be necessary to include also Oskar Peschel, author of the *Neue Probleme der vergleichenden Erdkunde;* see Kirchhoff, "Über Humboldt, Ritter und Peschel," *Deutsche Rev.*, January, 1878, whom he calls the three "Hauptlenker der neueren Erdkunde." See also the inaugural lecture at the University of Tübingen by Alfred Hettner, "Die Entwickelung der Geographie im 19. Jahrhundert," *Geog. Zeitschr.*, IV, 1898. Also note Oskar Peschel, *Völkerkunde*, Leipzig, 1881, and Alfred Vierkandt, *Naturvölker und Kulturvölker, Ein Beitrag zur Socialpsychologie*, Leipzig, 1896. To follow the subject even further, note must be made of Rougemont's *La Géographie de l'homme, ethnographique, artistique et historique*, translated into German in 1843, and the work of Arnold Guyot, whose relation to American geography is of especial interest. A native of French Switzerland, he settled in the United States in 1848, in his forty-first year. While intimately associated with the scientific life of his adopted country for the remaining thirty-six years of his life, he failed to create a following in the field that was his specialty, human geography. The time was not ripe at this stage of our national development for the doctrines of this disciple of Karl Ritter; when it was, the teleological principle had been displaced and discredited by the doctrine of evolution. See especially his *The Earth and Man: Lectures on Comparative Physical Geography in Its Relation to the History of Mankind*, Boston, 1849.

[3]The two great works of Elisée Reclus, who for a quarter of a century devoted himself to the reorganization of geography, must not be overlooked: *La Terre, Description des phénomènes de la vie du globe* (perhaps needing some correction), and the great work in nineteen volumes, entitled *Nouvelle géographie universelle, La Terre et les hommes.*

Until recent years, both in our classes and our examinations, what a singular importance was still attached to subprefectures! A very insignificant fact apparently, but a significant example. Pupils were led to put in the same rank in their minds cities such as Douai and Murat, Brest and Puget-Théniers, and to consider as analogous, as almost identical, a host of cities which have nothing in common except the tinseled uniform of a public official. Moreover, it was all too often in alphabetical order that the pupil had to recite the names of the subprefectures of all our departments, and even of the departments themselves—a sorry list, as instructive as might be an alphabetical list of the metalloids or of the kings of France. Let such tables be inserted, if one wish, in a supplementary chapter on administrative geography, but let them no longer form an essential part of even primary instruction. Such an ill use of time is in itself proof of a wrong conception of geography. It would doubtless be an error to judge of the development of a science merely by the instruction currently given in it; but the type of instruction is at least a revealing picture which furnishes us sure information.

It is important to recall briefly this almost contemporary past in order better to understand the import of Ratzel's work.

In 1882 Ratzel published the first volume of his *Anthropo-Geographie*.[1] To be sure, he was not the actual originator of this manner of viewing and analyzing human facts. Even in the writings of the greatest Greek historians and philosophers, whose work has already been noted, we find illuminating

[1]Friedrich Ratzel, who died August 9, 1904, professor of geography at Leipzig, is especially known as the author of *Die Anthropo-Geographie*, the first volume of which appeared in 1882 and the second volume, with the title without a hyphen, in 1891. A second edition of the first volume, much expanded and extensively reorganized, appeared in 1899. His *Politische Geographie* was published in 1897. Among his other important contributions to human geography should be noted the second volume of his *Die Vereinigten Staaten von Nord-Amerika*, first edition 1880, second edition 1893. Note also his "La Corse, Étude anthropogéographique," ***Ann. de géog.***, VIII, 1899, pp. 304–329. For a complete study of the development of human geography in recent years, see Ernst Friedrich, "Die Fortschritte der Anthropogeographie (1891–1902)," *Geog. Jahrb.*, XXVI, 1903, pp. 261–298; XXXI, 1908, pp. 285–461; XXXII, 1909, pp. 3–68. For an interesting discussion between Ratzel and one of the leading German geographers, H. Wagner, at the time of the appearance of the second volume of Ratzel's *Anthropogeographie*, see H. Wagner, "F. Ratzels *Anthropogeographie* II, oder die geographische Verbreitung der Menschen," *Zeitschr. der Ges. für Erdkunde zu Berlin*, XXVI, 1891, pp. 465–478; and F. Ratzel, "Erwiderung auf H. Wagners Besprechung der *Anthropogeographie* II," *ibid.*, XXVI, 1891, pp. 508–512.

and judicious suggestions which, in spite of their fragmentary and sporadic character, would allow us to invoke the old authority of Herodotus and Thucydides, of Hippocrates and Aristotle, in favor of this very recent geography. Ratzel chiefly followed tradition and developed, of course with more precision, the brilliant sketches of the celebrated Karl Ritter; he was inspired besides by excellent works of less known authors, G. B. Mendelssohn and J. G. Kohl.[1] But, by creating a word which should serve as a name for the new studies, he contributed more than anyone else to the great progress of this line of investigation. And to Ratzel's influence are due, in large part, the works on "human geography" which have multiplied in France and the United Kingdom in the last few years.

By his two-volume work, *Anthropo-Geographie*, by his *Politische Geographie*, by a whole series of other works, shorter and less synthetic, and by numerous investigations which his pupils have undertaken under his direction, Ratzel has in truth revivified the method of understanding humanity and human activity as geographical facts. He saw men as realities covering portions of the earth's surface, a living covering as worthy of study by the geographer as the plant covering or the animal population. He saw human groups and human societies developing, always within certain natural limits (*Rahmen*), occupying always a certain definite place (*Stelle*) on the globe, and needing always, in order to nourish themselves, to subsist, to grow, a certain space (*Raum*). History of course cannot be entirely explained through geography, but in the evolution of history, men, who are its actors, do not cease for a single day to tread the soil, and to make the resources of the earth serve for their maintenance. The most peaceful economic life as well as war[2] can be understood only if one never loses sight of these real "foundations" of all human activity. Besides, this activity finds expression in "visible and tangible" works, in roads and canals, in houses and cities, in clearings and cultivated fields. There is everywhere evidence of man.

[1]See G. B. Mendelssohn, *Das germanische Europa, Zur geschichtliche Erdkunde*, Duncker u. Humblot, Berlin, 1836; J. G. Kohl, *Der Verkehr und die Ansiedelungen der Menschen in ihrer Abhängigkeit von der Gestaltung der Erdoberfläche*, Arnold, Dresden and Leipzig, 1841.

[2]The second edition of the *Politische Geographie* has the following subtitle: *Geographie der Staaten, des Verkehrs und Krieges.*

All this takes on a new meaning under Ratzel's pen, for it is grasped and interpreted by him in a new manner. He possessed to a very high degree the sense of terrestrial reality. He perceived the human facts on the earth no longer as a philosopher or historian, or as a simple ethnographer, or as an economist, but as a geographer. He distinguished their manifold, complex, and variable connections with the facts of the physical order — altitude, topography, climate, vegetation. He observed men peopling the globe, working its surface, seeking their livelihood, and making history on the earth; he observed them with the eyes of a true naturalist.

It would take too long to point out all the subjects which Professor Ratzel has treated in the course of his very productive career; and besides, how can one analyze a mass of observations which have filled no less than 24 volumes and 100 monographs or articles? But it is important to recall some of his works which, though less generally known, are yet perhaps as important as his *Anthropo-Geographie*, and to indicate what precise knowledge and what natural gifts explain the intellectual range of his human geography and the scientific light that it sheds.[1]

If Ratzel, as we have just said, subjected geographical facts to the keen observation of a true naturalist, we must not forget that he began not only his works but his studies with the natural sciences. It was by travel, by direct contact with realities,[2] that Ratzel came to geography, like some of the best known geographers of contemporary Germany — Baron von Richthofen, Theobald Fischer, etc.

Some months before his death, in January, 1904, Professor Ratzel himself summarized the evolution of his career as follows: "I traveled, I sketched, I described. I was thus led to *Naturschilderung*. In the meantime I came back from America and was told there was need of geographers. I then

[1]Ratzel's field of scientific production was exceedingly broad; his writings deal with the natural sciences, general geography, ethnography, anthropogeography and biography, physical geography, the Alps, snow, history of geography, pedagogical geography, etc. At present the best authority to consult for a full list of his works is Victor Hantzsch, *Ratzel-Bibliographie 1867–1905*, published in 1906 as Appendix to Vol. II of the *Kleine Schriften*. These *Kleine Schriften*, published as a posthumous work under Ratzel's name, are edited by Hans Helmholt and published by R. Oldenbourg, Munich and Berlin, 1906.

[2]See one of the last works published by Ratzel: *Uber Naturschilderung*, 1904.

gathered together and coördinated all the facts I had myself observed and collected on Chinese emigration to California, to Mexico, to Cuba, and I wrote my inaugural dissertation on Chinese emigration." He became in 1876 *Privat-Docent* in geography and from the following semester professor of geography in the Technische Hochschule in Munich. In 1886 he was called to succeed Ferdinand von Richthofen at the University of Leipzig. There for eighteen years he generously spent his energy, training many pupils and exercising a scientific influence that passed far beyond the boundaries of Germany.

By a monograph on human geography the future author of *Anthropo-Geographie* had caused university professorships to open to him; but he was of those who are convinced — and rightly — that all serious and substantial human geography must rest on physical geography. In this field he brought his contribution of observations to the solution of divers problems, fiords, *lapiaz*, etc.; and published a very important work, *Die Schneedecke besonders in deutschen Gebirgen*.[1] The snow, said he, is not merely a meteorological phenomenon — it is a geographical fact, a surface fact; and in this properly geographical spirit he studied all the questions connected with the *Schneedecke*. Friedrich Ratzel was the organizer and editor of that very valuable collection of geographical handbooks "Bibliothek Geographischer Handbücher," to which we owe the *Gletscherkunde* of Heim, the *Ozeanographie* of Boguslawski and Krümmel, and above all the *Morphologie* of Penck and the *Klimatologie* of Hann. Those are high services. Ratzel never forgot the fundamental importance of physical geography, and it was to making more clear this union of natural facts with the geography of man that he especially devoted his last great work: *Die Erde und das Leben* ("The Earth and Life"), *Eine vergleichende Erdkunde*.[2]

It is a difficult matter to observe and explain natural facts; it is far more difficult to observe and analyze *facts of human geography*. The gift of observation, indispensable though it is, no longer suffices. It is impossible to be a good *human geographer* without a thorough historical, economic, and philosophical

[1] *Forschungen zur deutschen Landes und Volkskunde*, IV, 3, Engelhorn, Stuttgart, 1889.
[2] Bibliographisches Institut, Leipzig and Vienna, 1901 and 1902.

training; and in these fields Ratzel's mind was incomparably trained. Prepared for human geography not only by an extensive experience, but by special studies in ethnography and comparative ethnography, absorbed by the thought of never forgetting that, back of political and historical geography, peoples are still far more closely bound to their natural setting by all the acts of their material and daily life, he found before him all the fundamental problems of humanity, which remain the most obscure of philosophical problems.[1] Far from failing to recognize under what a complex and diverse form geographical reality reveals them to us, Ratzel, for these questions, always extolled the geographical method, thus opposing some of the most notable ethnographers and philosophers.[2]

Ratzel was fond of quoting Karl Ritter and of referring to "comparative geography." The name of the former deserves to be placed close beside the name of the latter. One cannot too often repeat to what an extent Ratzel was an originator of ideas, and justice should be done to him without reserve. It is nevertheless true that he had ideas in abundance rather than methodical discipline. His works, especially the later ones, do not sufficiently avoid dissertations foreign to geography. Those who have followed or still follow the teachings of Ratzel must help fill the principal gaps in the work of this founder of human geography: the pursuit of practical principles of observation and the establishment of a method of classification.[3]

[1]After keeping, for several years, a bibliographical record of the principal works on ethnography, in the periodical *Archiv fur Anthropologie* (1878, 1879, 1880), Ratzel published several memoirs: "Über geographische Bedingungen und ethnographische Folgen der Völkerwanderungen," in *Verh. der Ges. für Erdkunde zu Berlin*, 1880; "Die Stellung der Naturvölker in der Menschheit," in *Auslond*, 1882, Nos. 1, 2, and 4; then his three volumes of *Völkerkunde*, 1885–1888, reëdited in two volumes, 1894–1895.

[2]See, for example, "Die geographische Methode in der Ethnographie," *Geog. Zeitschr.*, 1896; "Der Ursprung der Arier in geographischen Licht," Seventh International Geographical Congress in Berlin, 1899.

[3]As early as 1899, in his presidential address, J. Partsch, to-day the successor of Ratzel at Leipzig, then head of the University of Breslau, compared Ritter's method and that of a pupil of Ritter's, Neumann, who was Partsch's master, with the method of Ratzel, and reproached Ratzel with not being sufficiently careful about overstating facts. He wanted long, precise works, like *Die Vereinigten Staaten*, rather than great syntheses (*Die geographische Arbeit des 19. Jahrhunderts*, Breslau, 1879). For the *desiderata* and for the method of human geography, see also Otto Schlüter, *Die Ziele der Geographie der Menschen*, Munich, 1900; Alfred Vierkandt, "Entwickelung und Bedeutung der Anthropogeographie," *Zu Friedrich Ratzels Gedächtnis*, Leipzig, 1904, pp. 378–409; and especially Alois Kraus, *Versuch einer Geschichte der Handels- und Wirtschaftsgeographie*, Frankfurt a. M., 1905. Finally, see A. J. Herbertson and F. D. Herbertson, *Man and His Work. An Introduction to Human Geography*, London, 1899; Ellen Churchill Semple, *The Influences of Geographic Environment*, Henry Holt and Co., New York, 1911.

2. THE FACTS OF HUMAN GEOGRAPHY CLASSED IN ORDER OF INCREASING COMPLEXITY. FROM THE GEOGRAPHY OF THE FIRST VITAL NECESSITIES (FUNDAMENTAL PHYSIOLOGICAL NEEDS: FOOD, SLEEP, CLOTHING, DEFENSE) TO POLITICAL AND HISTORICAL GEOGRAPHY

Certain needs of human life are so general and so uniform that they must be constantly satisfied. Thus men, wherever they live and whatever be their mode of existence, have need of air to breathe; similarly, as a result of gravity, they need a material and solid support, whether that support be the earth itself or, on occasion, the deck of a ship or the car of a balloon. These are conditions which from the very beginning have imperiously confined the inhabited portion of the earth to that zone where the solid surface and the atmosphere join and touch.

But there are other material conditions indispensable to human life which in different parts of the earth may be satisfied in many different ways. Merely to mention them is to indicate what are the causes and what are the chief forms of those unceasing relations that men are obliged to establish between themselves and surrounding nature. As human demands become more complex we shall see offered for our examination groups of geographical phenomena more and more complicated and confused. If, beginning with the humblest and most elementary facts, we first take a cursory glimpse of this crowded and heterogeneous domain, we shall then have to try to determine in the most careful manner what are the essential primary facts which human geography requires us to observe first.

1. Geography of the First Vital Necessities

A. Man has constant need of nourishment; several times a day he must renew his strength by eating and drinking. It is in the "thirsty countries," in regions poor in water, that we understand the imperative subordination of men to water; in the Sahara as in the Gobi, in the "arid region" of the Far West of America as in Arabia, all manifestations of human life follow the lines of the distribution of water. Those who seem to be the most independent of local conditions and who escape the geographical imprisonment of our sedentary life — the

nomads, the shepherds — do not escape the tyranny of water. All their travels, all their roads and trails, all their raids, must above everything else take account of water-holes; to renew their supply of water daily is the most constant and the gravest of all their problems.

Everywhere water reigns supreme over human activity. As for our nourishment, it is formed of plant or animal products, products which all come from beings occupying a place at the surface of the globe. More than that, the terrestrial animals from which human beings draw their nourishment feed upon plants or other animals which themselves feed upon vegetables. The geography of alimentation is connected not only with the general geography of life, but with the special geography of vegetation. Reduced to lowest terms, we find in almost all human nourishment a portion of the vegetal covering of the earth; the representative of a herbivorous species — ox, sheep, rabbit, camel, antelope, or elephant — crops each day for food the grasses of a small part of the earth's surface. Man's daily attitude is more exalted; his head and his tongue are farther from the soil; the food which the civilized man, or even the savage, assimilates has often been not only prepared but transported a long distance from its place of origin. And yet, if one looks closely, the meals of a human being represent, directly or indirectly, the "cropping" of a more or less limited expanse of the vegetal carpet, natural or cultivated, and show clearly that each person requires a "sustenance space" as he requires a "house space" in his hours of rest and sleep. Without the vegetation the cannibals themselves would not be able to live on our globe. And in the same way men who live on fish levy more or less indirectly for their daily repasts on a larger or smaller portion of that organic sea food, the *plankton*.

Every time that men slake their thirst or feed themselves they profit, then, by surface facts which they modify. The cumulative effect of these minor changes produces in the course of time extensive modifications in the distribution of the plants and animals that are the main sources of human energy. Thus man's regular periodic need for food and drink binds him closely to surface facts of plant and animal distribution which are

themselves dependent upon general and local conditions of the soil, the ocean, the climate. As a result of this levy by over sixteen hundred millions of human beings, the surface of the earth undergoes endless, immeasurable changes.

B. Every healthy human being loses consciousness in sleep for a part of every twenty-four hours. The lives of civilized men are so organized that the satisfaction of essential needs is assured by simple and normal means and we can hardly realize what the periodic tyranny of sleep means to the savage. We must think of the tramps of the highways, and the shelterless of the great cities — the victims of our social organization — in order to understand what an inexorable master sleep is, and what insistent cares it places upon man. Man, when unconscious, is an easy prey for those who wish to attack him, for his fellow men as well as for animals. Not being able to escape sleep except for a time and by abnormal means (the Fangs or Pahouins of the Belgian Congo, for example, make use of the kola nut to combat sleep), all men of all countries are led to seek shelter. This may be as rudimentary as can be imagined — interlaced boughs and vines in the thick tree crowns of the equatorial forests (dwarfs of central Africa), shelters under rocks (numerous prehistoric and existing peoples), holes in the snow (Eskimos). But, however rudimentary, the sleep shelter is still a definite point at which man installs himself for some hours and to which he is naturally inclined to return. Such is the origin of that very important fact of human geography, the habitation.

C. The human body must be kept at a certain temperature, about 37° C. (98° F.); too low temperatures eliminate all life. Because of this organic necessity, very high latitudes as well as very high altitudes are natural limits of human habitation. The human body, however, has a marvelous power of reaction against climatic conditions, especially if it is aided by clothes in its struggle against loss of heat. For the population of a great part of the earth, clothing thus serves a vital need, protecting the human body from the effects of low temperatures in the colder regions of the habitable world, and counteracting the effects of extreme heat and of rapid and great diurnal changes of temperature in the deserts.

It goes without saying that man can go naked in the hot, humid regions. Although the need for clothing is far from being as general and compelling as the need for food and sleep, yet, geographically speaking, this need has still a great significance. Man clothes himself almost everywhere with some animal or plant product — wool, cotton, linen — and thus, in his clothing as in his need for food and shelter, he depends in a certain measure upon his natural environment.

Food, habitation, clothing, these are the three essential foundations of all economic geography. In so far as they represent the more or less spontaneous satisfaction of primary needs, they form a first series in human geography.

Of the human facts enumerated, clothes are the least dependent upon the geographical environment, for they do not have to be renewed every day as food does; once manufactured, they last for some time. Further, clothes are by their very nature movable and transportable; they are not, like the usual habitation, attached to a given spot on the earth. Escaping the double servitude of incessant renewal and of localization, they also escape in a certain measure the strict tyranny of immediate natural conditions.

Eating must be constantly repeated and foods are, as it were, material bonds between man and the earth, which must be established at fixed hours. Many foods, however, are easily transportable and can be made available for use far from their place of origin. The people of western Europe consume large quantities of coffee, tea, and cacao, while the cow's milk from European mountain pastures is consumed by the inhabitants of Shanghai and South Africa. Although the ordinary food of certain human groups, especially primitive peoples, the *Naturvölker*, has a simpler and more expressive geography, yet it is none the less true that increased facilities of transportation tend more and more to intermingle all human foods.

The permanent habitation, occupying a fixed place, has the added interest, from a geographical point of view, that it is generally built of local natural materials. A movable habitation, the nomad's tent, shares in the ease of transportation

that characterizes clothing, and, geographically, it is a sort of clothing.

Of all the phenomena involved in the satisfaction of essential human needs, the habitation is to the highest degree geographical and hence must be given special consideration. A further reason for its exceptional place in the study of human geography is the fact that every form of human labor on the earth's surface is accompanied by human dwellings, if not permanent, at least temporary or intermittent. Everything leads to the house or groups of houses, villages, towns, or cities, so that at the end of the study of any phenomena of human geography, we shall be compelled to consider how these phenomena find further expression in houses scattered or massed together.

D. Mankind has a fourth fundamental need suggested by the primary purpose of the habitation as a protection during the hours of sleep, and that is for defense. Man must be protected, not only in his hours of repose, but in his hours of labor, if he is to work to the maximum advantage. The making of a clearing, at least "an arrow's flight" in radius, about a stockaded town, so characteristic a feature of colonial times in America, was for purposes of defense and served the same purposes as the tree houses of the Fijians or the cliff dwellings in prehistoric America.

Health laws in urban and rural communities, regulations in reference to the common towel or drinking cup, are means of defense against more insidious enemies than wandering savages or prowling animals.

The modern requirements in many communities that dangerous machinery shall be covered so far as possible to avoid accident, that employers shall be liable for damages to employees during working hours, are but refinements of the more primitive defense needs to meet the conditions imposed by current industrial conditions and practices.

Confidence due to a realization of adequate defense is an attribute of life essential to all progress. The means of securing that defense may be simple or complex, crude or refined, but the need always exists and man, either directly or through depending on others to whom the responsibility

is delegated, must be adequately defended against danger of all kinds.

2. Geography of the Earth's Exploitation

Thus far we have purposely spoken of the material facts which respond to the satisfaction of the first demands of human life, without examining the ways and means by which men arrive at the satisfaction of these demands. Men do not always rely for their food upon the mere picking of wild fruits (simple gathering), nor upon the killing of wild animals (hunting and fishing). They anticipate their needs perhaps months in advance and supply themselves with vegetable, animal, or mineral products. We thus distinguish a second series of more complicated facts into which the organized work of man enters as an essential factor.

The slightest cultivation of the soil shows an effort and a plan, a looking ahead to the morrow. Likewise, foresight is seen in cattle-raising, even in its most elementary form, and in washing gravel for gold, however crude the process. Let us note here that such facts have a geographical interest exactly in so far as they express themselves on the surface in material forms. It is not the psychological fact of the foresight which is important and which should claim our attention, but the material, the geographical expression of this foresight. The cultivation of cereals expresses itself by a field and a granary; primitive cattle-raising, by a more or less regular change of place; the labor of the gold or salt miner, by "works." The field and the granary of the cultivator, the itinerary of the nomad, the gold-seeker's installation, or the salt-mine, are the phenomena by which these human facts express themselves in the world of geography, and which serve to differentiate the second series of facts, involving organized work, from the first, which do not involve organized work.

From the order of facts that are spontaneous, or almost so, implying only impulsive and often immediate movements under the spur of vital needs, we come to an order of facts which is dominated by work for the future. All these surface phenomena can be grouped under the general head of exploitation of the earth. Agricultural geography, pastoral geography,

and industrial geography correspond to this second more complex series of facts.

3. Social Geography

One of the instincts and primal needs of man is to perpetuate his kind. It is not because of philosophical considerations that we have here to discern whether or not man is *Ζῶον πολιτικόν*. Everywhere we see the human species assuring the transmission of life and everywhere we find at least embryos of families and of society. Man is everywhere gregarious; it is an exceptional thing for an individual to live alone. If a person becomes a hermit, he is no longer a part of geographical humanity. It is only the chances of shipwreck or the dreams of mystics or idealists that make Robinson Crusoes or Stylites; the abstract systems of the philosophers or lawmakers alone can speak of man by himself as an isolated being. It is by an abstraction that we use "man" as a generic term to include all humanity. The truth is that human beings everywhere live in groups on the earth. This is one of the fundamental facts of human geography, which determines a third and very extensive series of phenomena. The simplest results of this grouping of human beings at all points of the earth are exchanges. Almost from its beginning and at least in one of the two individuals involved, exchange represents an effort and a plan — a foresight for the morrow; and this fact of exchange is especially important for us as soon as it expresses itself by that significant geographical reality, the market.

But men are not only compelled to distribute the products of the earth among themselves; they are obliged more or less clearly and conscientiously to regulate the conditions of production, the distribution of work, and, above all, the division of the soil. Generally speaking, the man who tills the earth, or he who raises a herd, does not work for himself alone but for a family or social group; the two men involved in an exchange are not individually isolated, but both belong to groups. All exploitations of the earth's resources are multiplied and perfected toward this social end. Children so young that their parents must support them, and old people no longer able to secure the necessities of life for themselves,

depend upon the able-bodied adults for their food, shelter, and clothing. Hence result more or less complex facts of organization which in a degree depend upon the conditions of work and yet in a measure react upon these conditions.

As soon as men wish to utilize natural resources and riches, they must solve not only technical problems — cultivation, mines, etc. — but further problems involving the coördination and subordination of their own efforts. Whether the ownership of property shall be communal or individual is a typical example of a large group of social facts which, by a more or less direct and happy adaptation, are the outcome of the exploitation of the earth.

According as human beings are placed in this or that geographical setting they are led to cultivate the palm tree, rice, or grain. Similarly they raise horses in the semi-arid steppes of central Asia, cattle in the mountains of central Europe or on the islands of Lake Chad or on the shores of Lake Rudolf, sheep on the lofty and dry plateaus of Spain or New Mexico. These different forms of activity bring about still different types of social organization. The conception and the limits of property are not the same for a farmer who every year tills the same field and for a herdsman who drives great herds of horses or camels across vast spaces almost treeless and without a fixed population.

We may group all these facts under the term "social geography," but we should not forget that, though these facts are associated with a given geographical environment, they depend especially upon human freedom and will. The analysis of them will, then, from the geographical point of view, be a very delicate matter, demanding both prudence and critical insight.

4. Political and Historical Geography

Finally the coexistence, in a given area of the earth, of numerous groups which are obliged to secure the necessities from the soil, creates certain necessary relations, now pacific, now violent, some of which are also connected with general or local facts of a geographic nature.

Still more critical and prudent must be the criticism of this fourth and last series of facts belonging to human geography:

"historical geography"—that is to say, political, military, and administrative geography. Such facts, it is easily seen, depend especially upon human vicissitudes and do not always have a truly geographical value or meaning. However, certain fundamental geographical conditions, such as topographical situation, altitude, orientation, proximity to the sea, size of the space occupied or conquered, etc., play such a rôle in the destinies of cities, provinces, or states that their history cannot be discussed without due consideration of the geographical surroundings. Far more, human history is deeply rooted, if one may so express it, in the material things of the earth.

Does that mean that all history can be explained by geography? Assuredly not. Historians at one time considered only those artificial labels on the earth's surface, the proper names—names of mountains, of water courses, or of cities. At another time, reacting against this entirely abstract view of terrestrial reality, they endeavored to establish general relations between the geographical character of a certain country and its historical destiny; they approached human geography at its end and unfortunately endeavored to solve first its most obscure and difficult problems. History evolves upon the earth, but it is made up of complex and involved elements that are removed as far as possible from elementary geographical conditions. It is by means of the intermediary facts of the second series—cultivation, grazing, etc.—and by facts of the third series—of social geography—that the profound echo of geography in the evolution of human societies is chiefly explained.[1]

[1]While such historians as Gibbon, Prescott, Motley, and Guizot have recognized the influence on human history of geographical conditions, the systematic study of this subject is of more recent date. A work of which the underlying conception is the relation of history to geography, is the *Weltgeschichte*, by numerous contributors, edited by H. F. Helmholt, 9 vols., Bibliographische Institut, Leipzig, 1899–1907, second edition in course of publication (see especially Lord Bryce's introduction to the English translation, 8 vols., Dodd, Mead & Co., New York, 1901–1907). A similar work, the labor of one man, is Elisée Reclus, *L'Homme et la terre*, 6 vols., Libr. Universelle, Paris, 1905–1908, a geographic interpretation of history, the master's last work. Cf. also H. B. George, *Relations of Geography and History*, third edition, Clarendon Press, Oxford, 1907; and A. P. Brigham, "Problems of Geographic Influence," *Annals Assoc. Amer. Geog.*, V, 1915, pp. 3–25. The two leading geographic interpretations of American history are Ellen Churchill Semple, *American History and Its Geographic Conditions*, second edition, Houghton Mifflin Co., Boston, 1913, and A. P. Brigham, *Geographic Influences in American History*, Ginn and Co., Boston, 1903.

Through a strange illusion, "historical geography," which is the most complicated phase of human geography, is at the same time the boldest, most adventurous geographical undertaking and one that has often appeared the easiest. He who glances at a map of the British Isles, and recalls vaguely the history of England, establishes so quickly a bond between the insular position of these lands and their historic destiny that he at once invokes geography as an explanatory cause of history; and he is not wrong. But these first general relationships are so obvious and so true that anyone with an open mind can perceive them; there is no need of laborious training in observation to see the general influence of the "insularity" of England upon the policy and destiny of Napoleon. But have we the right to stop with such easy comparisons? Can the true archaeologist content himself with perceiving the general relations between a Gothic cathedral and a certain period of Christian history? Can the true botanist content himself with perceiving some relation between climate or altitude and the development of great forests of pine or firs? Is the literary critic satisfied with establishing a relation of simple "contemporaneousness" between the works of Boileau, of Racine, and of La Bruyère? Should the geographer alone be the one to declare himself satisfied after having indicated some large and obvious relationship, exact though it be, between the general geographical situation of a country and its general historical destiny?

Likewise, if the analysis is not more precise, we run the risk of often reaching superficial or erroneous conclusions: witness how many of Michelet's eloquent generalizations![1] On the other hand, if it is proper to go farther, numerous difficulties arise. The task is too delicate to be accomplished at the first attack. The first consequence of this more scientific conception of the relations between geography and history is that we must begin with the more modest work of building our approaches.

In human geography, as in all the observational sciences, it is important to proceed by first classifying all the facts in series, by separating out a precise category from the crowded

[1] See Jean Brunhes, *Michelet*, Perrin, Paris.

whole of which it forms a part, and by continuing the comparative observation of these facts in a series of analogous, or similar, or progressively distinct, cases. Of this plan of procedure it will now be our first and most important care to point out with exactness the essential steps.

3. AN ATTEMPT AT A POSITIVE CLASSIFICATION. THE THREE GROUPS AND THE SIX TYPES OF FUNDAMENTAL FACTS. THE SMALL NATURAL UNITS: THE "ISLES" OF THE SEA, OF THE DESERT, OF THE FOREST, OF THE HIGH MOUNTAIN, AND OF THE PLAINS

We can now comprehend in what numberless ways, and under what very general conditions, the actions of men are influenced and sometimes even controlled by the physical world. This introduction to human geography is a sort of necessary preface.

The truly geographical point of view has been emphasized constantly in these earlier pages and attention has been given to the types of facts which form the field of investigation of a geographer. For instance, in speaking of farming, the raising of animals, or trading, it has been pointed out with much emphasis that, as geographers, we are not primarily interested in the psychological fact of foresight for the morrow, but rather in the results of this foresight as indicated by fields and granaries, by roads that pass by wells or pools, or by market centers. What are the world expressions of these scattered suggestions and can this definite point of view be used as the basis of a systematic classification that shall be truly geographical?

Human geography is first of all geography, and not psychology, sociology, or history. In the formative stage of its development, human geography was easily diverted from its proper field and thoughtlessly confused with the many other sciences dealing with man. It was easily accused, and not without reason, of "touching everything" without having a definite field and an organizing principle of its own. It is time to check all these haphazard wanderings, and the tendency of geographers is now to define their proper field of study and to confine themselves to it.

To consider first the physiological needs of man, as we

have done, is to explain how, from his earliest hours of existence, the human being, whatever he be, comes inevitably into contact with the physical world. These necessities once in mind, is there not urgent need of abandoning not only every *a priori* notion, every preconception, but every special fact concerning the human organism? Is there no way of putting less acquired knowledge of man and more geography at the beginning of all human geography? Is it not our duty as far as possible to free ourselves from every psychological, ethnological, or social conception and to devote our attention to the actual observation of the human facts on the earth with the least possible mingling of the subjective human element?

Suppose we rise in a balloon or an aëroplane some hundreds of yards above the ground, following practically the same idea as that expressed by the geologist Suess at the beginning of his great work, *Das Antlitz der Erde* ("The Face of the Earth"), and, with our minds freed of all that we know of men, let us try to see and note the essential facts of human geography with the same eyes and vision which would discover to us and distinguish the morphological, topographical, and hydrographical features of the earth's surface. From such a supposed observatory, what is it we see? Or, better still, what are the human facts that a photographic plate would register just as well as the retina of the eye? (Fig. 3.)

In the first place, we see men themselves, as a movable covering of the surface, but as a covering of very different density at different points of the globe. Yet this mobility is more restricted and this inequality of distribution is much more persistent and constant than one might at first suppose. Each individual, each little group, may move separately, and in fact does move; still it is none the less true that on the map of the world the large blots of living humanity appear for a long time in the same places. The general distribution of the larger human masses seems subject to a fixity, of course relative, and yet a fixity that is certain and surprising. The Siberian *tundra*, the Saharan *hamadas*, or the Amazon forest are almost devoid of men, while men are densely crowded on the moist and fertile deltas of the Orient, in certain districts

of western and central Europe, and along the northeastern shore of the United States.

With and besides men, and varying in numbers with the

tograph by Spelterini

FIG. 3. THE LIMMAT AND THE CITY OF ZÜRICH

This photograph, taken by the aeronaut, Captain Spelterini, from the car of a balloon at about 656 feet (200 m.) above Zürich, indicates clearly to what a degree the houses, streets, bridges, etc., as truly as a river, can lay claim to recognition as distinctive surface features of the crust of the earth.

population, appear other concrete surface facts which may be referred to six essential types:

1. FACTS OF THE UNPRODUCTIVE OCCUPATION OF THE SOIL

(*a*) *and* (*b*). *Houses and roads.*— First of all, one of the most visible facts, a sort of superficial excrescence, is the house, or, if one prefers, the shelter or habitation or human construction. All these innumerable and varied structures that dot the earth's crust with thousands of little points, red

with tiles, gray with slate, white with marble or lime, dark-brown with old thatch, or yellow-brown with dried leaves — all these facts, no matter what their size or permanence, and regardless of how they are spaced, we group under the general term of "houses." This title includes all human structures, from the humblest straw huts of the savage to the most elaborate mansions of our cities, the cupolas of observatories, or spires of cathedrals, and from the isolated huts or cabins of the arid steppes to those compact clusters of houses, so closely placed as to seem continuous, that we see in the large areas of dense population.

A second fact nearly always accompanies the first, that is, the "road," or the line of passage devoted and, if one may so speak, sacrificed to movement. The road includes the half-beaten paths that lead to the "chalet" or the shepherd's hut of the high mountain, great city streets paved or asphalted, white roads winding up the sides of the Alps, the Cevennes, or Mount Lebanon, railroads lined with parallel rails, and "flowing roads"— diked rivers or canals. With the "road," thus understood, are associated bridges and tunnels, strongholds or ports, and all the other concrete things that are the necessary complement or outgrowth of traffic and human communication. From the car of our balloon we note at the first glance how intimately, from the geographical point of view, the road and the house are associated and how they mingle still more closely where population is more concentrated. The city, geographically speaking, both in appearance and in reality, is made up of empty places as well as full — that is, of streets, crossways, and squares as well as houses and monuments.

"Houses" and "roads" are then closely associated over the inhabited earth and represent the two essential human facts of what might be called the "sterile or unproductive use of the land."

2. Facts of Plant and Animal Conquest

(*c*) *and* (*d*). *Cultivated fields and domesticated animals.* — Still other surface spots appear, more numerous as the population is more dense — spots with rather regular and seemingly

definite outlines, of tints varying with the seasons, now the dull color of the bare earth or the warm, rich color of the plowed ground, now the tender green of springing grass, the deep yellow of ripened grain, or the dazzling white of cherry blossoms or cotton bolls — spots corresponding to parts of the surface where the soil is scratched, turned over, or worked. In a general way, to use a term that summarizes what is actually seen, this is the "field" or the "garden." Such is the geographical and material expression of cultivation — that is to say, the subordination of the plant world to the human will. Whether it be wheat fields of the plateaus of Beauce or of the "black earth" of Russia, the terraces of lofty vine arbors or of old, twisted olive trees on the Mediterranean slopes, the closely aligned beds in the market gardens of the Paris suburbs, checkerboards of muddy rice fields in China or Java, thin forests of eucalyptus of the "oases" of the Roman Campagna, or old Saharan palm groves, sheltering under their slender shade, figs and pomegranates, barley and beans — all these "fields" or "gardens" are to such a degree marks of human toil that the photographic negative would record them, even when we remained unaware of the efforts that brought them about.

A fourth fact is to be noted, now associated with the "fields" or the "garden", now, on the other hand, often strong and well developed where cultivated spots are rare, but always linked with the presence of men. Scattered dromedaries and camels that feed on the stiff, hard tufts of the desert; groups of cattle that crop the short, sweet-smelling grass of the Alps; long, crowded processions of sheep that browse on the stalks and leaves of the dry steppes of the Mediterranean world; or Arab horses, each guided by human hands; reindeer drawing sleds over the snows of Lapland; Egyptian buffaloes dragging the plow under the goad of man and tracing the furrows of his field—all these form an animal population which is clearly subordinate to human will, a fact indicated by our common expressions, the "herd" and the "beast of burden."

It is through the definite forms of "fields" and "gardens," of "herds" and "beasts of burden," that we are led to introduce into geography the many varied facts included under the terms "cultivated plants" and "domesticated animals." In

one place they may date from an age so remote that their origin is a matter of tradition, and in another they may have been a sudden innovation of yesterday, but they comprise all that from the time of prehistoric man until to-day may be called "facts of plant and animal conquest."

3. Facts of Destructive Economy

(*e*) *and* (*f*). *Exploitation of minerals and devastation in plant and animal life.*—It remains for us to note from our point of vantage two other types of facts, both of which represent though in different degrees, "destructive economy," or, to use the forceful German term, *Raubwirtschaft*—that is, "economic plunder."

Here and there over the earth, and often near the house or the road, the soil is removed. Gaping holes mark the points where men, without restitution, have taken rocks for their own uses: "Sand pits," "gravel pits," "sulphur pits," marble, granite, or rock salt quarries, etc.—all these facts, minute or imposing, are, in a word, the "quarry." Geographically speaking, we pass, by imperceptible stages, from the quarry to the mine, from the earth that has been cut away on the surface to the earth hollowed out beneath. In the iron mines of Minnesota or in the copper mines of Chuquicamata (northern Chile), the pits are open, while in Westphalia, in the copper mines of Keweenaw Point, and in the Pas-de-Calais, the mines are developed some hundreds of yards or even thousands of feet below the surface. In each case the "hole" is made by man to remove once for all mineral substances, such as silver, diamonds, coal, salt, or plaster; and the "hole" is literally a mark of "destructive economy."

The sixth and last type of surface facts are closely bound up with the facts of "plant and animal conquest." We have to do here with all those acts, often brutal and violent, almost always short and quick, always decisive and final, which, in the vegetal order, are seen in wild fruits seized and eaten, trees felled and forests burned, and, in the animal order, in animals hunted and killed or fish caught. Devastation and pillage of the cultivated oasis by the nomadic Tuaregs and the senseless and ill-considered exploitation of the rubber vine in the Congo

are facts analogous to the excessive hunting that tends to exterminate certain species, such as plume-bearing birds and fur- or ivory-bearing animals.

4. The "Islands" or "Islets" of the Inhabited Earth

Later we must consider the general reaction of facts upon one another and not neglect that "geography of the whole" which is in truth the highest goal of geography study. It is difficult to make out at first glance what is really and strictly geographical in the manifestations of human life in vast, dissimilar settings, each corresponding, for example, to a "whole" as complex as France or the United States. Only by the careful study of a small unit can one learn to discern and evaluate the strictly geographical relations between physical facts and human destinies. Among those points of our inhabited planet that are isolated enough to form separate and therefore simple unities, five types of little geographical worlds, five types of islands or islets of humanity, seem especially marked for our observation. They are:

the islands of the sea;
the oases which are "islands" of the desert;
the populated "islands" or "oases" of the boreal or of the equatorial forest;
the high closed valleys of mountain regions;
the isolated mountain areas that rise in the midst of extensive plains.

4. The Natural Forces. Water and Wind. Human Beings. The First Maps: Rainfall and Population Maps

Among the natural facts and forces to which man is geographically bound almost as closely as he is to the air, water deserves a place in the first rank. Water is preëminently the economic wealth: it is, for men, more truly wealth than either coal or gold.

Not a house or human shelter has been built without some attention being given to the availability of a water supply; the humblest chalet in the high mountains is situated first of all near a spring or a stream; every village must have its spring or its well. In some countries where the climate brings a

prolonged period of dryness, the roofs and terraces are arranged so as to catch all the rainwater in cisterns. (Figs. 4 and 5.)

Jean Brunhes

FIG. 4. THE UPPER TERRACES OF BELLVER CASTLE, NEAR PALMA DE MAJORCA, BALEARIC ISLANDS

Everything on these terraces is so arranged as to collect even the smallest drops of rain that fall.

We have already compared Champagne and the Central Plateau of France from the point of view of the distribution of human establishments; we might in the same way compare Beauce and Brittany. Better still, let us choose districts almost adjacent, such as a portion of the Central Plateau and a portion of Burgundy with fissured limestone;[1] or two agricultural plains in the immediate neighborhood of Paris — Beauce and Brie.

In Beauce, where the plateau is covered by grain fields as far as one can see, trees are very rare and are found only a few in a place;

[1] See Paul Girardin, "Le Relief des environs de Dijon et les principales formes topographiques de la Bourgogne," *Ann. de géog.*, XI, 1902, pp. 43–53.

the large villages are far apart and always situated about a large well equipped for furnishing water quickly. One rarely finds a well used by one farm alone. It is just the opposite on the plateau of Brie, lying at a lower level on the right bank of the Seine. This area, with a more varied surface than Beauce, is well supplied with living springs and streams. And so, beautiful estates, recognized from a distance by a girdle of great trees as well as by all the signs that accompany isolated farms, are scattered over this verdant

Jean Brunhes

FIG. 5. THE WELL OF THE GREAT CISTERN IN THE INTERIOR COURT OF BELLVER CASTLE

The rain is gathered and stored, even to the smallest drop, in the great cistern that extends below the large central interior court.

country, the surface of which is agreeably divided between great woods and cultivated plains.

Often, as is clear from Figs. 6 and 7, page 57, the human map rigorously follows the lines of the hydrographical map.

In studying the formation of the city of London, Prestwich showed that, for centuries, the population had unconsciously located itself exclusively within the boundaries of the water-bearing layers, so

that the plan of the capital and its suburban parishes reproduced exactly the distribution of the ground-water.[1]

One of the largest problems of great cities is that of water supply — a problem of public hygiene and social life of primary importance, and worthy of examination as a whole from an especially geographical point of view. Thus, whether it be the humblest chalet or the largest dwelling, the human house is necessarily bound to a certain quantity of water.

Streets and the road are also surface facts that must have water. The historic routes of travel of the desert nomads, the buffalo trails of the Great Plains, are almost as rigorously subject to the distribution of water-holes as our trains are subject to stops at fixed stations. These stations are always watering-points, and the fastest expresses of our most highly developed roads, with means of locomotion seemingly most independent of the detailed facts of the geographical environment, must make stops to supply the boilers with water.

The facts of destructive economy are somewhat less dependent upon water than the two types of facts of sterile occupation of the soil, but here again, through the relations that exist between the plant world and water as well as between wild animals and water, it would be easy to show that real relationships exist between these less systematic forms of human activity and the distribution of water. With regard to fishing, the relation is obvious. As to quarrying and mining, they demand a large quantity of water either for the work itself or for the lives of the employes. The huge hydraulic works that have developed in the exploitation of gold in the deserts of western Australia are well known.[2]

But if, from this group of facts, we pass to a consideration of plant and animal conquest, the geographic necessity of water appears to be still more imperious. All raising of animals is based upon water; even the camels of the Sahara as well as the sheep of the lofty plateaus of the Barbary States must slake their thirst. As for cultivation, it is preëminently a question of water.

---

[1] A. de Foville, *Introduction a l'enquête sur les conditions de l'habitation en France, Les maisons-types*, I, p. x.

[2] See Paul Privat-Deschanel, "Le Problème de l'eau a Coolgardie" (Western Australia), *La Géographie*, XIV, 1906, pp. 13–18.

Some of the fundamental facts with reference to the water demands of our crops are worth noting. According to Haberlandt, a very green leaf evaporates in an hour a quantity of water equal to its own weight. This chemist has calculated the amount of water evaporated per acre during the growth of different grains:

QUANTITY OF WATER EVAPORATED PER ACRE

CEREALS	POUNDS
Wheat	997,570
Rye	743,723
Barley	1,101,880
Oats	2,028,987

For the production of a pound of dry matter, wheat requires 515 pounds of water; rye, 365 pounds; barley, 543 pounds; oats, 1,001 pounds. Experiments at Akron, Colorado, in 1911, gave a requirement for wheat of 507 pounds of water per pound of dry matter, of 724 pounds for rye, 539 pounds for barley, and 614 pounds for oats.[1]

Evaporation is more rapid in regions of abundant sunshine, and in dry climates water is most needed for cultivation. This fact emphasizes, in a word, to what extent artificial watering or *irrigation* will be for man the most efficient method of plant culture in arid, semiarid, or desert countries (Fig. 8).

It is therefore in considering the garden and the irrigated field that we see the true relations between man and water; and of our six essential facts, this is the one that must be the foremost geographical reality and which serves, so to speak, as introductory to the examination of the more general problem.[2]

It is also in connection with the field carefully worked that we shall meet with *dry farming*. By repeated tillage to prepare the ground to absorb and husband even the slightest rain, dry farming especially expresses, so to speak, all that water is worth.[3]

[1]Lyman J. Briggs and H. L. Shantz, *The Water Requirements of Plants*, I, *Investigations in the Great Plains in 1910 and 1911*, U. S. Dept. Agr., Bureau of Plant Industry, Bulletin No. 284.

[2]J. Brunhes, *L'Irrigation, ses conditions géographiques, ses modes et son organization dans la Péninsule ibérique et dans l'Afrique du Nord*, Paris, 1902; F. H. Newell, *Irrigation in the United States*, The Macmillan Co., New York, 1902.

[3]"Dry farming" is one of the oldest and richest traditions of the Mediterranean world. See "A Majorque et à Minorque, esquisse de géographie humaine," in the *Rev. des deux mondes*, November 1, 1911; and Augustin Bernard, "'Dry Farming' et ses applications dans l'Afrique du Nord," *Ann. de géog.*, XX, pp. 411–430. See also J. A. Widtsoe, *Dry Farming*, The Macmillan Co., New York, 1911; and W. MacDonald, *Dry Farming*, The Century Co., New York, 1909.

Water is, then, associated with all human life, and, if Ratzel could say at the beginning of his *Politische Geographie*: "Jeder Staat ist ein Stück Boden und Menschheit" ("Every state is a bit of soil and humanity"), let us take his phrase and complete it: every state and even every human group is a blend of a bit of humanity, a bit of soil, and a bit of water.

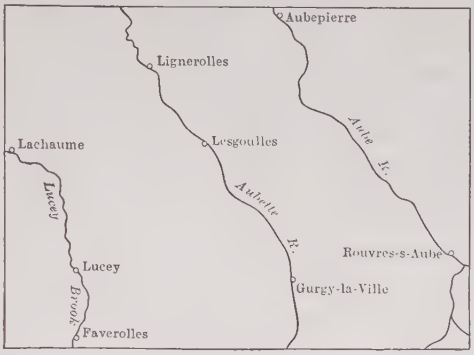


FIG. 6. THE DISTRIBUTION OF HUMAN SETTLEMENTS IN REGIONS OF FISSURED LIMESTONES

That is why all hydrography, terrestrial or marine, has had a very great influence upon humanity from the beginning. The sea attracts men because it is at the same time a road and a fishing ground. When the mighty tide swells the estuaries and ascends the streams of the British Isles, it increases enormously the line of contact between the sea and the land and the intensity of movement and traffic that can result therefrom;[1] the flood-tide which makes possible the entrance and departure of great vessels is like a drawbridge thrown across a moat, reëstablishing

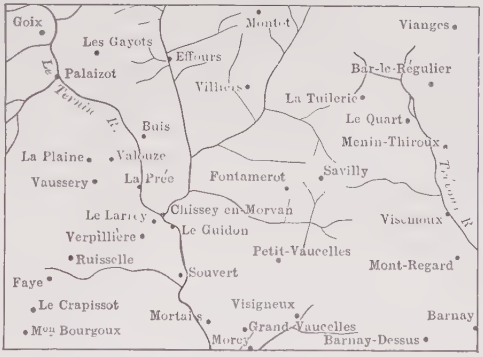


FIG. 7. THE DISTRIBUTION OF HUMAN SETTLEMENTS IN A DISTRICT OF IMPERMEABLE ROCKS

These map-sections represent areas of the same size in two regions quite near one another: those of Châtillon and the Morvan. This part of the Châtillon, calcareous and very permeable, has only a few rivers, on which the inhabitants are grouped; there are neither hamlets nor farms. The Morvan, formed of crystalline rocks and well watered, has numerous streams; water is present everywhere; farms, hamlets, and villages are scattered throughout.

Maps from *La France et ses colonies*, by H. Busson, J. Fevre, and H. Hauser, Paris, F. Alcan, 1910, p. 33.

[1] To the detriment even of inland navigation. See A. Demangeon, "La Navigation intérieure en Grande Bretagne," *Ann. de géog.*, XXI, January 15, 1912, p. 41, last paragraph.

the continuity of the road of approach. And, as a foster-mother, the sea, in spite of the efforts by some states at limitation, is the most extensive *common* of the world.

Looking at this group of facts from the truly geographical standpoint, it is evident that they depend on some one of the six types of essential facts. Whether he will or no, consciously or unconsciously, every writer who attempts an exact discussion arrives necessarily — with more or less clearness — at this elemental analysis. A page from Vallaux will furnish us the proof:

> Boysen has remarked that the English Channel, because of its traffic, has permanently a population as dense as the province of Yakutsk; would it not be then, as well as the province of Yakutsk, a part of the inhabited world which geographers must study?
>
> Boysen's remark is interesting, but, taken literally, it would bring about certain misconceptions that we must take care to avoid.
>
> Of course, if we consider the Channel as a continental shelf (it is one since its depth does not exceed 300 feet [100 meters] except in the narrow trench or deep of Alderney), and if we consider it consequently as a fishing zone, it is an inhabited zone, less populated in fact than any other similar zone, such as the Dogger Bank or the Vendean coast of Brittany. If we consider it as a region of constant and uninterrupted passage between France and England, it is again an inhabited region. But, however interesting these two characteristics of the Channel may be, it is not to them principally that it owes the numerous population which plows its waters and which Boysen has in view. It owes its population above all to its position as an outlet from northwest Europe toward the Atlantic and as a way of approach from the entire Atlantic to continental Europe. Under this title, which is its chief title, the Channel is not an inhabited region, for the population of the passenger and merchant boats across this sea, for the most part, is without stop or stay upon its shores. To this mobile and traveling population the Channel gives no geographical environment; it serves simply as a means of connection between numerous fixed environments from which the men who pass through it separate themselves in groups, masses, or unities.[1]

But water is something more than this for man. Obeying the pull of gravity and descending the mountain toward the sea, it is a force that can become a source of energy. For centuries it had set in motion mill wheels and saws (Fig. 10). Then came the hour of the almost indefinite increase and

[1] C. Vallaux, *La Mer*, pp. 8–9.

perfection of methods of utilization of the "white coal" and "green coal."[1] "This water so rebellious," says Gabriel Hanotaux, "why not muzzle it at its birth?"[2]

And during the last twenty-five years, through the development of hydro-electric power houses and the transmission of power by electricity, there has come about a mighty industrial revolution which gives to countries deprived of coal, such as Switzerland or Norway or California, an economic power and rank that it would have been impossible to imagine or foresee. Let us, however, study somewhat more closely such a phenomenon in its entirety on a map such as that of Wyssling, *Carte des stations centrales d'électricité en Suisse* (Kümmerly

Jean Brunhes

FIG. 8. A SMALL IRRIGATION CANAL OR BISSE OF THE VALAIS

The Valais is the most arid region in Switzerland, and that is why the water from the glaciers is there carefully collected and conducted for the irrigation of the upper pastures. The irrigation canals, called *bisses*, are miniature works of art consisting sometimes of tunnels, and sometimes, as in this case, of flumes simply but skillfully constructed. The water in this *bisse* flows from the Trient glacier.

[1] On the subject of "green coal," consult the investigation made by Henri Bresson, *La Houille verte, mise en valeur des moyennes et basses chutes d'eau*, Paris, 1906. See also Charles Barrat, *Les Forces hydrauliques de la France et la houille verte*, a communication made to the Société de statistique de Paris (May 13, 1907), Nancy, 1907.

[2] G. Hanotaux published under the title of "La Houille blanche," in the *Rev. des deux mondes*, an article of such great importance that it influenced the modification of jurisprudence. These pages are reproduced in *L'Energie française*, Flammarion, Paris, pp. 163–197. Apropos of Dauphiné, he writes: "It is nevertheless true that one of the most active and noblest provinces of France, peopled by mountaineers ordinarily classed among 'backward communities,' has created and developed without outside assistance a magnificent industry born of the soil, the future of which is immense. The sons of the mountain have wrested from the mountain a force it was expending uselessly" (p. 187). On the subject of "white coal," see *Congrès de la houille blanche*, Grenoble-Annecy-Chamonix, September 7–13, 1902, Grenoble, 1903.

et Frey, Bern, 1902). The truly Alpine region, the region of high mountains, appears to us as still being poor in electrical plants; the existing plants are isolated and furnish power only for a short distance, while in the Swiss Jura and on the great *molassic* plateau power houses with long transmitting lines are numerous.[1] (Fig. 9.)

The reason is that man has found on the plateau, if not more available water than in the Alps, at least streams with more volume and force. He has found especially more population and more labor, therefore more facilities for the creation and organization of factories to use the power produced by the waterfalls.

Certainly we are coming to see more and more clearly that high falls are particularly valuable and that a movement to lead industries toward the high mountains is taking place, but alas, how slowly![2]

It is the human phenomenon that, above everything else, directs this utilization, and it is through the increase in population, through the construction of factories, through the creation of a network of communications, that is, once more, through some of the essential facts of the preceding section—houses and roads—that this new fact of the domestication of natural forces is revealed. It is becoming more and more obvious to men that it is to their interest to take advantage of the free forces of nature.[3] This evolution is carefully noted in a general work on *L'Homme et la terre cultivée* ("Man and the Cultivated Earth").

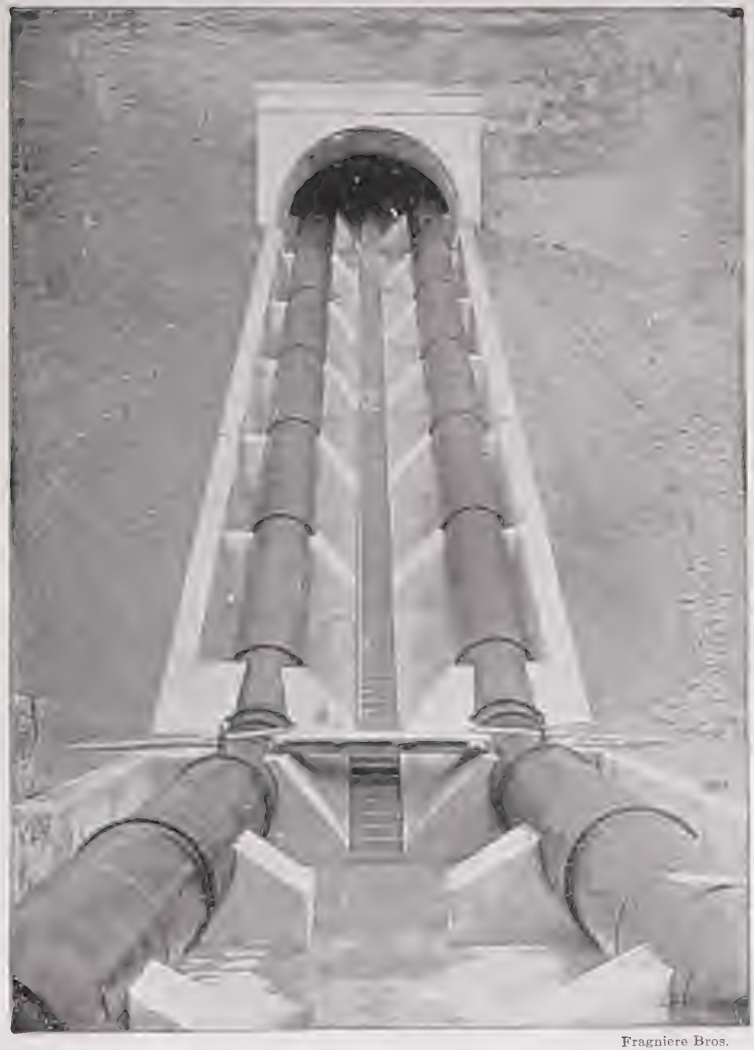
The wind is another natural force that seems to be coming back into favor. It was a valuable aid at a time when man

[1]The phenomenon appears still more clearly, if possible, in the second edition, which dates from 1907: *Carte des stations centrales d'électricité en Suisse, dressée comme complément de la carte du professeur Dr. Wyssling et éditée par l'Assoc. suisse des électriciens.*

[2]J. Dalemont, "L'Énergie des cours d'eau en Suisse," *La Géographie*, XVI, 1907, pp. 291–308. See what this says of the "ascent of factories toward the mountain," p. 298, and the diagram, Fig. 26, representing the number of central factories built in Switzerland from 1891 to 1903, classed according to the height of the waterfalls utilized. In a still more recent work, *Les Industries de l'électricité au Canada*, Julien Dalemont, speaking of the 394,400 horse-power already taken from Niagara Falls, insists upon the part which the preceding economic facts, especially facts of population, play in the utilization even of hydro-electric forces (*Rev. écon. internat.*, Dec., 1909).

[3]See Brunhes, "L'Homme et la terre cultivée, Bilan d'un siècle," *Bulletin de la Société neuchâteloise de géographie*, XII, 1899, pp. 219–260. See III, "Better Economy of Riches and of Natural Forces."

was less spoiled than to-day and could use only the feebler sources of energy. In Germany and Holland, as in Spain, the huge wings of windmills still stand out everywhere on the horizon. It was the wind that ground the grain and sped the



Fragniere Bros.

FIG. 9. ONE OF THE GREAT "CENTRALS" OF THE SWISS PLATEAU: THE PRESSURE PIPES AT THE HYDRO-ELECTRIC WORKS OF HAUTERIVE, 2½ MILES (4 KILOMETERS) ABOVE FREIBURG

ships of our forefathers. The century of steam and electricity has caused this power of the wind to be neglected and almost forgotten. It is, to be sure, a capricious and irregular force, but it is a force that is free and inexhaustible. To-day we are again turning to the wind. Wind motors as well as steam engines are used. To a steam engine for raising water for irrigation, for example, we join a wind motor. Even if this motor should save only the coal that the steam engine would burn in twenty-four hours, it is a clear gain. Air motors are increasing in number over the great plains of the Dakotas and in France, particularly in some departments of the southeast.[1] In the same way navigation by means of sails, far from disappearing, is being developed, although the modern sailing vessel may have an auxiliary steam motor for use in case of need. On the sea, as on the land, man is turning once more to this force for the moment despised; a new age of wind power is about to begin.

Courtesy of H. Busson

FIG. 10. TRADITIONAL UTILIZATION OF HYDRAULIC POWER
A large water wheel, in the vicinity of Murcia

Now, from the geographical point of view, windmills must be included in the same group with water mills. Sailing vessels, geographically speaking, will not be separated from the steam vessels which follow the same courses and carry the same merchandise. It is not the forces conquered but the resulting

[1] There are still many regions where wind motors are used in raising the water necessary for market gardening. Few regions are so characteristic, from this point of view, as the immediate environs of Dresden, in Saxony.

surface phenomena that furnish the basis for a geographical classification.

Finally, among the facts which our vision of the earth's crust reveals to us, we have pointed out, as of the very first rank, that unequal covering formed by the human population itself. Men, too, must be looked upon as a sort of natural force which here exists and there is rare; as a sort of fundamental fact which it is in human power to utilize far more than to modify suddenly or radically. When, as a result of an economic or historical fact such as the South African War, the black labor had disappeared or fled, it was discovered how difficult and dangerous it was to repeople a section of the earth. Even though the central power desirous of finding workmen was one of the most powerful on the globe and the interests to be safeguarded were the interests of gold, and even with the attempt at a partial transplanting of the yellow race to this

From U. S. G. S.

FIG. 11. A VIEW OF THE GREAT EASTERN IRRIGATION DITCH. GARDEN CITY PROJECT, KANSAS

Wind motors used in connection with a gasoline or steam engine for the raising of water represent a large saving in fuel.

land of impoverished "human vegetation," the endeavor to reëstablish the earlier conditions was but a slow and sorry procedure.

This simple instance may serve to introduce the general consideration of that terrestrial surface fact, the population. The phenomena of life are not merely the results of

geographical causes, nor are they fatally and closely bound to them and them alone; it would be a mistake to think it. But while geographers have not to seek the remote beginnings nor to investigate the obscure and confused complex by which the present population is explained, must they not at least be asked to investigate the present influences? But do these influences themselves all belong to the domain of geography? Who would dare claim that the natural environment furnishes the key to all these phenomena, so fascinating and so involved, which form the object of study of demography: birth-rate, proportion of marriages, mortality, etc.? What will be the part of human geography here? In what places and by what modes must demography profit from geographical observations and by its own results benefit geography?

It evidently goes without saying that it is from the critical studies of great censuses that geographers have been able to form a clear idea of the predominating facts of population. The countries which have methodical censuses at regular intervals, from almost all the European states and the United States to India or Egypt, are the ones where the geographer finds a hold, so to speak, and can make his judgment sure.

P. Vidal de la Blache, while insisting, as is proper, on the importance of facts of population, has justly said:

> There is at the base of political geography a question that may be considered as fundamental; that is the question of the distribution of human populations over the surface of the earth. Nothing is more unequal: certain relatively restricted parts of the globe show enormous accumulations; India and China alone contain nearly half of humanity. These are masses of human beings cemented by time, against which wars, epidemics, and famines wear themselves out in vain. On the other hand, there are vast new spaces which man is just beginning to occupy in large numbers. Now, with regard to these phenomena, which have a resulting influence upon the entire geographical physiognomies of the districts, we have only begun to be informed since regular censuses, still too few, have allowed us to compare the state and progress of population in widely separated parts. It was a revelation when in 1872 the first census of British India showed us positively the existence of nearly 250 millions of men (to-day 291 millions) in that peninsula. Since 1790 the monumental series of decennial censuses in the United States of America has not ceased to furnish valuable documents for following the progressive increase of population in a vast country.

We are thus enabled to study comparatively the geographical aspect of the population in countries of old civilization, whether in Europe or in the tropics, and in new countries such as America. And we find strange phenomena, some of which have been forcefully set forth by F. Ratzel. The United States contains some of the great metropolises of the world, although the density of population is only thirty-three inhabitants per square mile (thirteen per square kilometer). Australia has more than 30 per cent of its people in three cities. The enormous inequalities of distribution which these figures indicate exist even in the immediate radius of great cities. A few hours separate New York from the wooded solitudes of the Adirondacks. Had it been in Europe, clearings would have been made in these forests; through factories or different occupations a population would have striven, and probably with success, to create in them means of existence for itself as it is, a few hunters or woodsmen, and they only in the summer risk themselves in these solitudes. Such is a demographic picture of a new country.[1]

But how do these phenomena of population reveal themselves to us? How are they even approached and measured, so to speak, by censuses except through the habitation? Because of the fact of the material establishment at a given place on the land men are "caught" and counted. Where men are not thus fixed they escape all control and all accurate numbering. Now the earth's covering of human dwellings is a phenomenon more geographical, more closely bound to natural conditions, than the earth's covering of human beings itself. The first is the visible sign of the second and is preëminently within the province of geography. Truly geographical demography is above all the demography of the habitation.

Let us add that the two facts of sterile occupation of the soil—houses and roads—arrange themselves in varied networks which are literally representative plottings of the population. A moment ago there was mentioned "the demographic picture of a new country" drawn from statistics. A still more expressive idea could be drawn from maps on a large scale. A piece taken from a good topographical map is preëminently a "demographical picture of a new country." (Fig. 12.)

The human fact as a force applied to the transformation of the surface of the earth will manifest itself as an explanatory

[1] "La Géographie politique, à propos des écrits de M. Frédéric Ratzel," *Ann. de géog.*, VII, 1898, p. 105.

and coöperating factor in each of the visible and tangible results of this transforming work: apropos of the cultivated

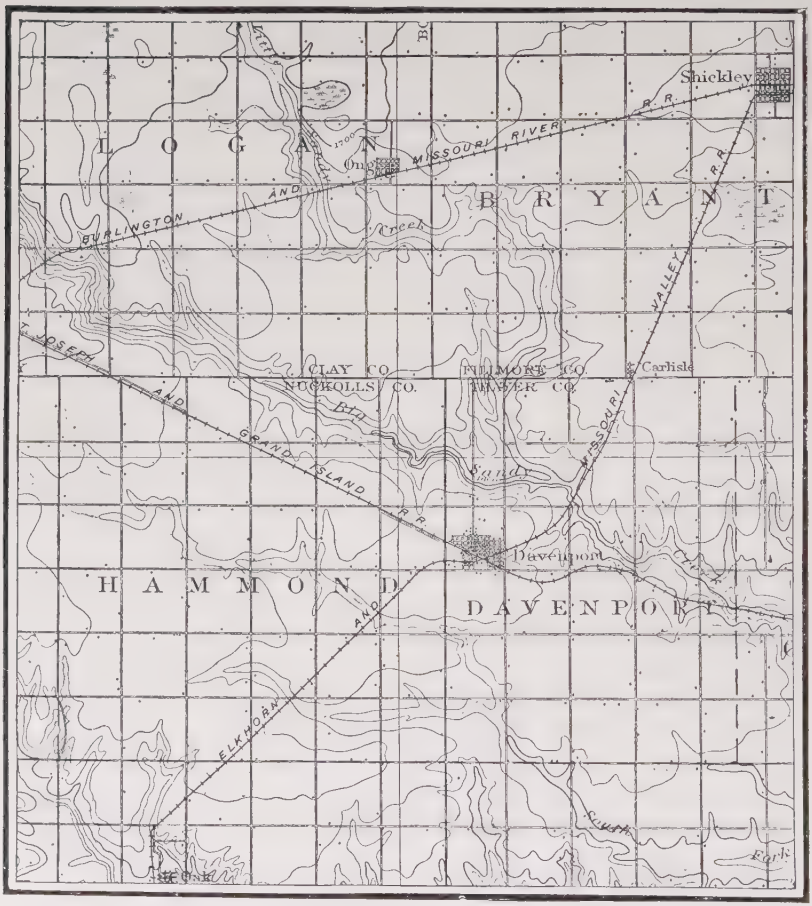


Fig. 12. How the Settlement of a New Country Marks the Ground

Portion of the Hebron Quadrangle U. S. Geol. Survey, showing the strikingly regular distribution of houses on the dry plains of the West settled under the various Homestead Acts.

field or the mine, men will have to be studied in so far as they determine these facts and in so far as they remain connected with them. We shall see how the factor of "labor" is introduced into all studies of cultivation, of devastations, of the exploitation of minerals.

Nowhere does man exist without doing something; everywhere he at least eats and sleeps; and everywhere he leaves the marks of his passage which are *par excellence* the object of our particular studies.

Proceeding by way of analysis and following our principle of classification, we must go over again, step by step, the problems of population. It is in connection with the house, the village, and the city, that the question of the distribution of population must be examined — under its real and logical aspect — as well as the question of the maps and diagrams intended to show that distribution.

The Two Primary Maps of All Human Geography

On the whole, if we wish to draw any general conclusions from a critical examination of the natural forces which are everywhere basal to all human geographical facts, we consider as fundamental maps the *map of water* and the *map of men;* that is, the map of the general distribution of the rainfall and the map of the general distribution of the population (Figs. 13 and 14).

All the water, either for his life or for his work, is not furnished to man by the rainfall alone, and those who engage in irrigation in a dry country know this better than anyone else. But the expenditure of time, money, and human muscle required for artificial watering makes us recognize by contrast the full geographic and economic benefit of rainfall which is shed in drops over such vast surfaces. Directly or indirectly, almost all the water that we use, whether it be spring water, well water, or other water, is due to rainfall. Excess of rainfall is, moreover, like the dearth of rain, unfavorable to the free extension of human life; the fullest and best development of humanity is limited to areas lying between these two extremes of rainfall. In these intermediate zones we find all the great centers of population. We shall have occasion to take up this very important point again when we come to discuss those occupations and industries which are most directly connected with climate, that is, the works which involve vegetal and animal conquest. (See § 1 of chap. IV, pp. 230–249.)

FIG. 13. GENERAL DISTRIBUTIO

The two continuous heavy lines mark the southern limits (in the north
(exception made of some isolated, very high elevations as Ruwenzori and Kil
The works of Supan, Loomis, A. Angot, Hann, Woeikof, etc., also rem
LII, 1906, T. 7., etc.) have been consulted. But the data are taken principa

ECIPITATION ON THE GLOBE

sphere) and northern limits (in the southern hemisphere) of the snowfall

special publications (rainfall map of Africa by Fraunberger, Pet. Mitt., the rainfall map of Andree's Atlas (4th edition) published by A. Scobel.

It remains none the less true that a general rainfall map represents one of the great terrestrial facts the actual distribution of which controls in the highest degree the geography of man.

The distribution of human beings is another all-important geographical fact. Once more, it is not our purpose to study here groups of human beings from the ethnological or historical point of view; there is no doubt that facts of race and of history are of great significance in explaining the present distribution of men. To make the actual dispersion of men dependent upon geography alone would be an error. The two Americas, which to-day, invaded by migrations of men from the Old World, show themselves so favorable to population in so many regions, were for a long time in places a juxtaposition of uninhabited districts. A hundred years ago they were devoid of men in comparison with other parts of the world, such as Europe, Asia, or even Africa. Even to-day the comparative table of absolute area and population of the continents justifies the declaration that human beings are localized and distributed on the earth in a manner that is far from being exclusively dependent upon natural conditions.

COMPARATIVE TABLE OF POPULATION IN 1910

TOTAL POPULATION OF THE EARTH IN MILLIONS OF INHABITANTS	SURFACE IN MILLIONS OF SQUARE MILES			AVERAGE POPULATION OF CONTINENTS PER SQUARE MILE
	Whole Earth	Continents	Seas	
1,665	197	57.5	139.5	29

	Population in Millions of Inhabitants	Surface in Millions of Square Miles	Average Population per Square Mile	Proportion of Earth's Population
America.....	181	16.2	11.2	10.9%
Asia.....	893	17.0	52.5	53.6%
Europe.....	449	3.9	115.1	27.0%
Africa.....	135	11.5	11.7	8.1%
Australia and Oceania....	7	3.4	2.1	.4%
Polar Regions	0.013	5.5	.002	....

In Asia, which is only one-sixteenth larger than the Americas, lives a population that is almost five times the population of the New World. Europe, which is only one

fourth as large as America, has over two and a half times as many inhabitants as America.

A critical and detailed examination of regions having close natural analogies would be still more instructive.

We shall, then, have ground for repeating, in chapter VIII, that human geography, properly so called, must be first and above all the geography of material human works; it is also the geography of human masses and human races, but only in so far as these masses and races express their specific and distinctive modes of activity by material works, and in so far as they reveal their existence and their presence by these same works.

Certainly there are real relations between the general map of rainfall and the general map of population. (Figs. 13 and 14.) The study of plant zones in relation to climatic zones, to be taken up later, as well as the vegetation and climatic maps (Figs. 111 and 112), will further bring out these connections. However, we shall consider here the two groups of facts, rainfall and population, as providing the fundamental factors, the primary and almost brute factors, of the infinitely varied play of causes and effects which ends in covering the surface of our globe with a multitude of human marks and traces.

From these different records of observation it is evident that all the phenomena of human geography can and must be examined in the light of the facts that we have designated under the term of essential facts. The question is now to undertake a more detailed analysis of these facts with the aid of numerous examples.

FIG. 14. GENERAL DISTRIB

These population maps of the hemispheres are from the *Teachers' Geograph*

Compiled by Mark Jefferson, Ypsilanti, Mich.

THE POPULATION

rk Jefferson, and are reproduced here by courtesy of the author.

CHAPTER III

THE ESSENTIAL FACTS OF HUMAN GEOGRAPHY

FIRST GROUP: FACTS OF THE UNPRODUCTIVE OCCUPATION OF THE SOIL: HOUSES AND ROADS

1. *The form of the house. Typical houses. Examples: (a) the wooden house in forested northern and central Europe; (b) the house in Egypt: the house of earth and the house of stone.*
2. *The material characteristics of the street and of the road.*
3. *The physiognomy of the human establishment: geographical types. Example: the village-type in Egypt.*
4. *The geographical localization of the human establishment. Site. Dissemination or concentration. Limits.*
5. *The urban agglomeration and the city road. The large city and large cities. Brief comments upon an example of comparative geography: the large cities of the world above 5,000 feet (1,500 meters).*
6. *Urban circulation and the fortification. A geographic feature of the city: the "boulevard" as a fact of urban geography.*
7. *The general geography of circulation.*

The human habitation — a small geographical phenomenon so intimately associated with our lives — is almost as ephemeral as we ourselves. In the best preserved cities the oldest houses go back only some three or four hundred years; in general the ordinary house is replaced frequently as the generations come and go. If a fact that changes so quickly still keeps the same general characteristics and, as it were, a physiognomy that is handed down, it is certainly because a real power of tradition influences its successive forms; but it is also because the human house depends upon natural conditions to an extent which is yet to be defined and which is, moreover, variable.

Even the house of the urban center shows this dependence. Toulouse is a city composed of brick houses, and certain of its most celebrated monuments, such as the marvelous Roman basilica of Saint Sernin, are likewise of brick. By contrast a commonplace building in a street near la Dalbade enjoys the solemn title of "The Stone House." Similarly, on the quay of the city of Antwerp is a building called the "Steen" (Stone), a fact which indicates to what an extent the rest of the town is built of other materials, in this case of brick.

But it is especially the rural house and the isolated house which best show the characteristics of this dependence upon the geographical environment.[1] The geographer is interested above all in the most representative type of a given region. He has no interest in the more or less costly abnormal house which expresses only the individual taste of the owner. The pseudo-Italian villa built in the Vosges Mountains or on the Swiss plateau, as well as the pseudo-Swiss chalet built on the shores of Lake Maggiore between Pallanza and Intra, the plaster façades of which bear painted representations of the trunks of larch trees, are generally detestable artistic atrocities and are in any case geographical absurdities. That which is exceptional has less value, in the study of human geography, than that which conforms more closely to a "type."

I. THE FORM OF THE HOUSE. TYPICAL HOUSES. EXAMPLES: (*a*) THE WOODEN HOUSE IN FORESTED NORTHERN AND CENTRAL EUROPE; (*b*) THE HOUSE IN EGYPT: THE HOUSE OF EARTH AND THE HOUSE OF STONE

Many scholars and artists, archaeologists and architects, have been interested in noting, by description, drawing, or photography, the forms of the urban or rural house.[2] The

[1] Apropos of *L'Habitation humaine dans le Sénonais*, Paul Privat-Deschanel goes so far as to say: "We will confine ourselves to the study of the rustic [peasant's] house, which alone is closely connected with local geography" (*La Géographie*, XVI, 1907, p. 209), a slightly exaggerated formula, but one arising from a correct idea.

[2] The literature on this subject is so abundant that only the more significant references available can be given here; as for instance Dohme, *Das englische Haus*, Braunschweig, 1888; Aug. Ahlqvist, *Die Kulturvölker der westfinnischen Sprachen. Ein Beitrag zu der älteren Kulturgeschichte der Finnen*, Buchh. Wasenius, Helsingfors, and in Commission Leipzig, Leopol Voss, 1875, chap. IV: *Wohnung, Hausgeräth, Kleider*, pp. 101–160. See also the very remarkable and well-illustrated Polish work on the marvelous wooden architecture of Tatra: M. W. Matlakowski, *Popular Architecture of Podhalau;* with reference to Switzerland, consult: A. Sutter, *Schweizer Landschafts- und Architektur-Bilder* (in 3 series), M. Kreutzmann, Zurich;—Rahn, *Geschichte der bildenden Künste in der Schweiz*; and especially the works of

form of the house interests the geographer not so much in its details as taken as a whole, or, more exactly, in so far as the materials of construction bring about a certain form, and as the adaptation to geographical conditions is shown in the general plan. Travelers who pass through new and distant regions are more frequently struck by the signs of this geographical dependence than we are by analogous facts nearer home. One sees in the middle of a stony steppe a wretched house like the one in Fig. 15. It is certainly the blocks of stone strewing the ground that have been piled up to make the walls, and the great stalks of the dried-up vegetation that have been brought together for the roof. This house is, as it were, a piece of natural vegetation.

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FIG. 15. STEPPE HOUSE OF THE UPPER JORDAN

The walls are made of the blocks of limestone strewing the ground, and the roofs of the stems of the tall weeds seen in the foreground at the right.

Gladbach, *Der Schweizerholzbild, Die Holzarchitektur, Charakteristische Holzbauten der Schweiz.* Especial note should be made of the series of works by the late Hunziker; the title of the first volume, published in 1890, is: J. Hunziker, *Das Schweizerhaus nach seinen landschaftlichen Formen und seiner geschichtlichen Entwickelung*, first part, *Das Wallis* (Aarau, 1900); and in French; *La Maison suisse d'après ses formes rustiques et son développement historique*, French translation by Fred. Broillet, first part, *Le Valais* (Lausanne and Aarau, 1902). See also XII[e] Bibl. 1902 of the *Ann. de géog.*, No. 304. The series is continued by some volumes published after the death of Hunziker by C. Jecklin, translated by Broillet, *Les Grisons, Le Jura comprenant la Suisse romande à l'exception du Bas-Valais, des Ormonts et du Pays d'Enhaut*, etc. The Swiss Society of Engineers and Architects has begun a large publication on the bourgeois house; *Das Bürgerhaus in Uri*, Basel, 1910. Finally, if we leave Europe, we should need several volumes to hold the bibliography of a multitude of studies. Other important monographs are: Richard Mahler, *Siedelungsgebiet und Siedelungslage in Oceanien unter Berücksichtigung der Siedelungen in Indonesien*, which appeared in *Archiv internationales f. Etnographie*, Suppl. gr. 4°, V, 1898; Bastian (A.), *Die Culturländer des alten Amerika*, 3 vols., Berlin, 1878-1889: *I, Ein Jahr auf Reisen: Chile, Peru, Ecuador, Colombia, der Isthmus, Guatemala. Aus Religion und Sitte des alten Peru;*—II, *Beitr. zu geschichtl. Vorarbeiten auf westl. Hemisphäre: Gesch. der Inca in Peru, Gesch. des alten Mexico, u. s. w.;*—III, *Nachträge u. Ergänz. aus den Sammlungen des ethnologischen Museums*, etc.

Let us, however, pass by all these facts which depend so strikingly upon the geographical environment: the snow huts or *igloos* of the American Eskimos;[1] the summer *chum* and the winter *yurt* of the Ostiaks;[2] the gray felt tents of the nomads of central Asia; the Tahitiar or Congo huts of leaves or stalks; the round, thatched huts of Harrar at the foot of the Abyssinian plateau; the houses of eastern Bolivia,[3] with roofs of foliage and without walls.

From the studies of Frobenius, as from many others, we get the impression that, in spite of the principles of imitation and repetition which have an ethnic significance, varieties which are dependent upon geography appear everywhere. It was formerly thought that in the entire Sudan there was but a single dominant form of habitation—the round hut with a conical roof. What a multiplicity of forms adapted to their surroundings have recent explorations revealed!

We likewise once considered certain types of habitation as corresponding to a period of human history and even, in certain cases, to an age of humanity. Learned ethnographers have shown, as far as Europe alone is concerned, that the lake-dwelling populations are not at all represented by a single ethnic group, and that the bond of resemblance existing between the forms of habitation of these very different populations results from the same need of defense which had to be met in like geographical surroundings.[4] Even to-day many people build upon piles, and one of the latest explorers of Sumatra considers that the chief reason for building upon piles is not to place man in safety from ferocious beasts or from his sometimes no less ferocious fellows, but particularly to raise him above the immediate surface of the soil which in equatorial regions is much too damp in the rainy season (Fig. 16).[5]

[1]See, for example, Captain Roald Amundsen, *The Northwest Passage*, 2 vols., New York, 1908.

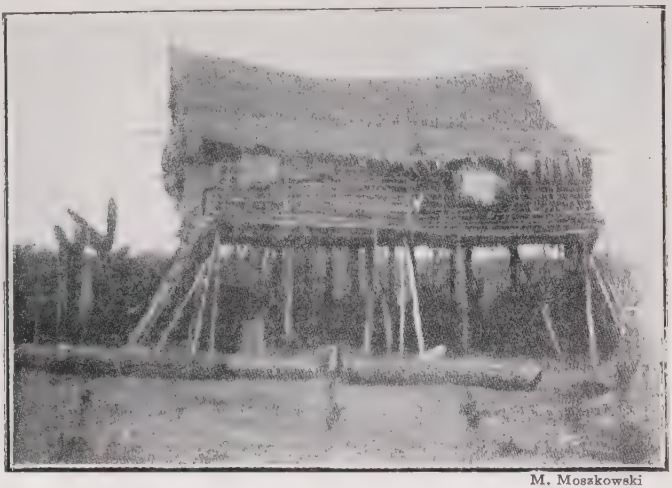
[2]Charles Rabot, "Les Ostiaques, les Samoyèdes et les Ziriènes, d'après les travaux de M. Sommier," *Revue d'ethnographie*, 1889.

[3]See *La Géographie*, September 15, 1900, pp. 226, 227.

[4]Marquis de Nadaillac, "Les Populations lacustres de l'Europe," *Rev. des questions scientifiques*, October, 1894.

[5]See M. Moszkowski, *Auf neuen Wegen durch Sumatra, Forschungsreisen in Ost- und Zentral-Sumatra* (1907), Dietr. Reimer (Vohsen), Berlin, 1909, p. 267. See chapter iv and figure on p. 79, as well as chapter xii and figures on pages 270, 272, 274, etc.

The troglodytes are not merely prehistoric groups. Men have lodged and still lodge in caves in regions where rocks which are at the same time soft, homogeneous, and dry, such



M. Moszkowski

FIG. 16. A CONTEMPORARY SUMATRA DWELLING ON PILES

as the Turonian chalk or the Swiss Molasse, permit them to make a sufficient shelter at small expense. We must with good reason speak of modern, of contemporaneous, troglodytes.[1] Without even going as far as America or Africa, one may examine their habitations as a type of human geography in France and in Switzerland[2] as well as in Italy, where the Central Bureau of Statistics informs us that more than 200,000 persons now inhabit more than 37,000 subterranean dwellings. In the south of Spain there are numerous inhabited

[1]See the studies by Dr. Bertholon in the *Bull. de la Soc. de géog. commerciale de Paris;* D. Bruun, *The Cave Dwellers of Southern Tunisia*; Johnston, "A Journey through the Tunisian Sahara," *Geog. Jour.*, 1898, pp. 38 ff.; and more recently, Pierre Prins, "Les Troglodytes du Dar Banda et du Djebel Méla," *Bull. de géog. hist. et descriptive*, 1909, No. 1; J. Russell Smith, "The Desert's Edge," *Bull. Amer. Geog. Soc.*, see Vol. XLVII, 1915, pp. 813–831 (on the Matmatas, pp. 824–829).

[2]Village of Orival (Lower Seine), village of Haute-Isle (Seine and Oise), the neighborhood of Tours, etc., caves in the neighborhood of Fribourg (Switzerland), etc. For France, see Philibert Lalande, "Les Grottes artificielles des cavernes de Brives (Corrèze)", in *Mém. de la Soc. de spéléologie*, January, 1897; Abbé Parat, *Les Troglodytes contemporains*, reviewed in *ibid.*, IV, pp. 44–45; and for Switzerland, J. Früh has published in 21–24 of the *Globe*, 1897, some very interesting articles on modern troglodytes. See also Jacques Flach, *L'Origine historique de l'habitation et des lieux habités en France*, pp. 4–5. The valley of the Ourcq is especially rich in subterranean dwellings which are called *boves*.

caves near Jaen or Granada. A similar case occurs in one of the basins in the midst of the Betic Cordillera, where, in the little town of Guadix, 3,000 inhabitants live in dwellings, revealed only by their whitewashed chimneys, which have been hollowed out of a conglomerate coherent enough to stand unsupported and yet easy to excavate (Fig. 17).

The following brief sketch will indicate how rich in results would be a complete geographical study of simply the form of the house in central Europe as well as in the Mediterranean world, that is to say, in two contrasted areas in which may be seen the infinitely varied effects of an already very ancient history.

In traveling from north to south over the vast plains of European Russia,[1] where natural zones succeed each other with a simple clearness that is not to be found in central, southern, or western Europe, one is struck by the regular succession of prevailing types of human habitation. In the north, in the zone of the *tundra*, whose frozen subsoil bears but a meager and uniform flora of cryptogams without forests or crops, there are no fixed human shelters except huts. Then comes the great forest, the largest remaining piece of the enormous boreal forest of old, and there we meet with the wooden house. Then, toward the south, extend the herbaceous steppes with the rich "black earth" region where the house is built of earth or adobe and covered with thatch or clods of turf. When this region without trees or

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FIG. 17. A GROUP OF SUBTERRANEAN DWELLINGS

Contemporary troglodytes in Spain: subterranean Guadix. The little city of Guadix has 14,000 inhabitants, of whom more than 3,000 live in cave dwellings.

[1]See Alfred Hettner, *Das europäische Russland, Eine Studie zur Geographie des Menschen*, in 8 vols., Teubner, Leipzig, 1905; and also Alois Kraus, "Landbau und Landbauzonen Russlands," *Jahresbericht über die Prager Handelsakademie, 1898–1899*, Prague, 1898.

stones is succeeded by the stony steppe of Crimea or the chains of the Caucasus, the stone house reappears, while on the southern slope of the western and central Caucasus a vegetation of trees and shrubs with pliant stalks points to a warm and humid climate and expresses itself in certain accessory buildings, such as barns, made of wattle work.

1. General Survey of the Wooden House in Forested Europe

Let us consider in detail the wooden house — the chief of these types.[1] By examining it briefly in its entire geographical distribution let us see how far we can answer these four questions: Where is it? How is it made? How far does it extend? What becomes of it?

Where is it? (geographical zone).—The wooden house, as it exists in Finland and Russia, belongs, as we have said, to the great northern forest. This forest formerly extended almost unbroken over the whole of central Europe. The excessive clearing due to increased occupation has cut it up. This region did not and could not become populated except at the expense of the forest. At many points the human settlement, even in the immediate neighborhood of large cities, such as Munich, appears as an opening or clearing in the midst of the trees (Figs. 18 and 19). Thus large islets of this primitive forest still remain in the mountainous plateaus of the Hercynian or the Alpine zone, the Harz Mountains, the Black Forest, the Alps, etc. Wherever wide stretches of the forest persist the wooden house appears, in Sweden as in Bohemia, in the French Alps as in the Swiss Alps.

The boreal forest is made up of the more northern species, such as the birch, and of others more southern, such as the beech; but everywhere they present the common twofold characteristic of being composed chiefly of trees with very straight trunks, such as the fir, the Scotch pine, the beech, and of being pure growths of each of these species over vast extents. These are the two characteristics of the forest which proceed to put their stamp, so to speak, on the form of the house.

[1] In Russia only 4 per cent of the houses are of stone (*Les Forêts de la Russie*, 1900, p. 17).

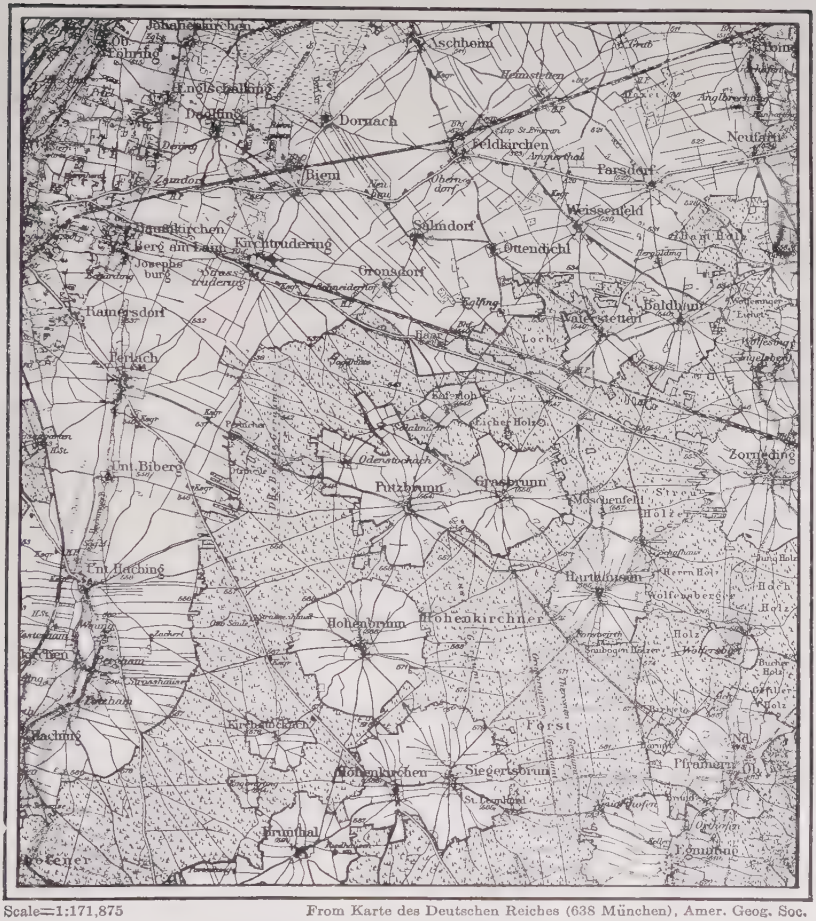

FIG. 18. HUMAN SETTLEMENT IN THE FOREST OF CENTRAL EUROPE

This region, situated southeast of Munich, reveals in the map, in the form of clearings in the great forest, how human settlements were made. If in this map the meadow land were included within the forest contours, the regularly circular design of the clearings would be still more striking.—History confirms these facts, still so apparent on the map to-day. Following are the dates when the principal settlements were first mentioned: Hohenbrunn, 812; Siegertsbrun, 1075; Putzbrunn, 1095; Brunthal, 1073; Grasbrunn, 1160. It is not surprising to discover that the three first settlements named were founded by the convent of Benedictines at Tegernsee. The land-clearing monks were the first to open up the vast forests of Germany.

How is it made? (geographical form).—The straight trunks of these trees can be easily superposed or cut up into boards. The houses, in their simplest form, are built by the

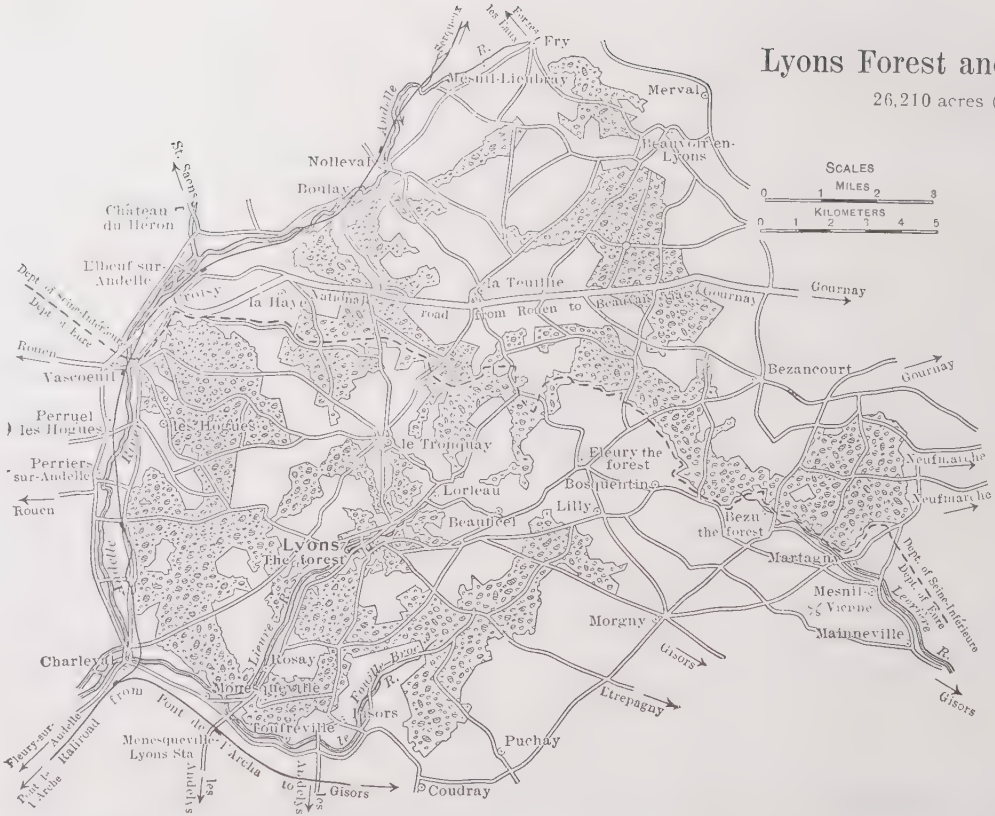

FIG. 19. HOW A VERY BEAUTIFUL FOREST, FORMERLY CONTINUOUS, HAS GRADUALLY BEEN OPENED UP, TRAVERSED BY ROADS AND CUT TO PIECES.

For this same point of view see the illustration which shows the progress of "deforestation" in a modern industrial region (Essen-Bochum), chap. V, pp. 392–393.

This engraving has been kindly loaned by the Touring Club of France, which is active in preserving the still beautiful remnants of this Lyons Forest, typical of the forests of western Europe (departments of Eure and Seine-Inferieure in France).

superposition of timbers or logs, sometimes in the rough, sometimes more or less regularly squared. These pieces of timber are joined at the corners. By the use of boards, more complicated and varied forms of construction are possible. The first type does not lend itself to so many combinations. Geographically speaking, it is more shaped in advance, and it is for this reason that the walls of the house in Finland are exactly like the walls of the *mazot* in Valais, like those of the little Czech village or of the Swedish forester's hut; and if we follow the great boreal forest to other lands, we find the same type with superposed and united timbers in the Siberian *taïga* or where frontier conditions still exist in the great northern forests of America (Figs. 20, 21, 22, and 23).

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FIG. 20. THE WOODEN HOUSE OF FORESTED EUROPE. A SWEDISH DWELLING-HOUSE

Environs of Åre, in the interior of Sweden, not far from the Norwegian frontier. The sides, made of joists carefully squared and joined, are covered with a coat of red paint which protects the wood against the wet. The roof is covered with thin slabs. The chimney is built of flat stones.

In the Russian forest the wooden house is such a common thing that it is the basis of a special traffic. Even before the improvement of roads and of methods of communication, portable houses of wood existed in Russia. The *Almanach de Gotha* for the year 1823 reminds us that "the seat of the wood industry is at Yaroslav, Tula, Kursk, and Moscow"; then it adds: "In this last city ready-made houses of wood, which can be set up and taken down at will, are sold to peasants."

The wooden house was once far more general in some of the

countries where it is seen to-day. The reason for its disappearance will be taken up later.

An historical work by Marius Besson begins thus: "Everything leads us to think that, in our regions, religious edifices of the early Middle Ages were generally of wood. Thus is explained their disappearance."[1]

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FIG. 21. IN SWEDEN, NEAR RAGUNDA

Typical hay-barn, the walls of which are made of small straight, joined logs and the roof covered with thin wooden slabs. To be compared especially with the haybarn of Fig. 22: resemblances are striking in spite of the thousand miles which separate the two regions.

In Sweden, in Norway, in Russia, as in Switzerland, many old churches or small chapels are still made of wood. The national expositions of bygone types of constructions have brought once more to light for our admiration the most curious of these types. The following was published as a result of the Geneva Exposition of 1896:

The houses of wood can be divided into three great groups: those of the plains, which are very much decorated and of which the type perceptibly approaches stone buildings; those of the mountainside, likewise skillfully decorated but belonging more particularly to the chalet type and no longer having the huge pointed gables or the façades with horizontal cornices of the former; finally, those of the high mountains, in which the wood is more or less squared, the ornamentation rudimentary, and which show no notable differences of form and structure.

These last are represented in the village by small chalets and genuine *mazots;* their roofs with two very flat slopes are covered with shingles or lath held in place against the wind by large stones. They present a compact mass capable of resisting the heaviest falls of snow. Decoration is lacking (they are, in general, nothing but barns), consisting of hardly more than a symbolical figure hastily cut above the door, accompanied sometimes by a date or name. . .

[1]On this point, see a number of texts dealing with ancient Gaul, collected by A. Marignan, *Le Culte des Saints sous les Mérovingiens*, Paris, 1899, pp. 149–150.

In fact, most of the rural dwelling houses are made of wood. It is an old custom; the Burgundians and the Alemanni constructed their houses of the trunks of trees sawed or cut the same length, placed upon each other and notched at the point of union in such a way as to avoid intersections. These trunks were fastened together by means of pins of oak or cherry. Before the time when they were squared they were hewn into various forms.

Formerly the peasant who built a house was helped by his neighbors. The wood was sought in the forest, the cellar was dug, and the foundation was laid of rough stones taken from the immediate neighborhood and joined with mortar. There was no thought of locks; a simple catch served as a lock. Finally the covering was made of the larger waste pieces from the squaring.

In eastern America the house- or barn-raising, where all the men of a neighborhood joined in the setting up of the prepared frame, was an occasion for a social gathering and

O. Marinelli

FIG. 22. IN THE COMELICO (CARNIC ALPS)

This is a *fenile* (hay-barn) situated at 4600 feet (1400 meters) altitude. It is constructed of small logs roughly squared and joined.

(See further the resumé of the studies by O. Marinelli on the Comelico, Chap. III, pp. 157–164).

jollification until the "balloon type" of building succeeded the "frame" building. Even to-day "raisings" are occasionally held in the more rural communities.

Red spruce was used particularly, first of all because of the magnificent red-brown coloring which this species of wood acquires after long exposure to the air.

In the mountains the roofs were covered with laths, strips of wood, more or less large, held in place by stones lest the wind should carry them away. In the plain, where straw is abundant and where the roofs must be very peaked in order to make room for the storage of hay and other harvest products, roofs of thatch were used for a long time.

The covering of the house is, in all climates, a delicate and difficult problem. In the northern forest it is made relatively easy by those fine, straight tree trunks which furnish the framework. To make the roof itself, men have recourse, according to the circumstances, to thin pieces of wood—*bardeaux*, *Schindeln* (shingles) (Figs. 20, 22, and 23)—or to thatch (Fig. 24) or even to flat stones, such as the large slabs of schist with which the inhabitants of Valais cover their *mazots*.[1] Likewise the form of the roof will depend, to a considerable extent, upon climatic conditions.[2]

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FIG. 23. THE WOODEN HOUSE IN SWITZERLAND

At Ringenberg, on the shores of the Lake of Brienz. The foundations are of masonry; well squared and smoothed trunks are joined at the corners; the roofs are shingled and strewn with crosspieces and stones to keep the shingles in place.

Throughout the Alps the two-sloped roof of the high mountain chalet is less steep because it must support the snow which, in midwinter, the peasants like to keep on their roofs as a means of protection from the cold. In the low mountains

[1]Even in Russia, where abundant iron has favored the use of roofs of painted iron, it is well to remember that this characteristic roof, always very noticeable to the traveler, is above all an *urban* roof, and that only .5 per cent of the roofs in all Russia are of metal, while 30 per cent are of wood and 69.5 per cent are of thatch. The wooden roofs correspond with the forested zone.

[2]Climate expresses itself chiefly through the form of the roof. In his *Esquisse géographique du Vivarais*, R. Blanchard has clearly brought out the contrast between the Mediterranean valleys and the bare, denuded plateaus of the Montagne, swept by the violent gusts of the *burle:* "It is still in the dwelling that the contrast is most extraordinary. We left behind at Montpezat storied houses (often with two or three stories), with rather flat tiled roofs, sometimes projecting in a gable above the façade, to protect it from the torrents of rain."

or in the Swiss *Mittelland* the roofs with two or four sides are much steeper, either to allow the rain to run off better or in order that the less abundant and less persistent snow may slip off more easily (Fig. 24; the inclination of the roof is less in Fig. 25, than in Fig. 24).

To the north of Bern, the house is entirely hooded by its roof, a real cover of thatch or wood which comes down on four sides with a steep and even slope, to within two yards of the ground, and hides nearly all of the walls. The house is protected by its roof on all sides; there are nowhere any large clear spaces. If we walk around it we can catch only a glimpse of the bottom of the door, or here and there the beginning of a window between the base line of the roof and the ground.

But a new style is being developed in the midst of the ancient type. The more modern house has joyously turned up the edges of the old roof and raised it especially in front to form a frame for its elaborate façade. The façade roof of the coquettish and multiform chalet of the plain is placed and arranged almost like a woman's hat—susceptible of undergoing and displaying the capricious fantasy of each little group of the population and almost of each individual. The house with the old four-sided roof is everywhere the same; the chalet everywhere varies. Might we not say, to express our thought in a word, the strictly

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FIG. 24. A HOUSE OF THE SWISS PLATEAU NORTH OF BERN

Large roof with four sides, thatched and very steep, constructed with much care and very durable. In certain more ancient houses, the overhanging eaves are still nearer the ground.

traditional hood of the old grandmothers has become a hat?

Here is Emmanuel de Martonne's description of the wooden house of another region, far distant from the Swiss plateau—the range of Paringu in the southern Carpathian Mountains:

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FIG. 25. A CHALET OF THE HIGH MOUNTAINS IN THE BERNESE COUNTRY

Above Lenk, at an altitude of 6,000 feet (1,700 meters). The walls are of stone; the roof is covered with small slabs of wood carefully superposed and fitted; this covering is rounded even at the four angles of the roof, so that the water from the snow can not penetrate into the interior of the chalet.

> The architecture of the *stina* is of the simplest. The walls are generally formed of rough tree trunks resting upon corner pillars planted in the ground. The wind passes freely through the unstopped cracks. Sometimes there is a sort of basement made of dry stone (without mortar). The roof, two or three times higher than the walls, is placed upon them like a cover that can be taken off, and resembles a boat with a straight keel and flattened bow and stern. It is made of strips of wood nailed upon each other like slates (*sindrele*).

Such are some of the truly geographical elements of the wooden house. How have they been combined: roofs of thatch with houses of timber, roofs of slate with houses of boards, etc.? How are their parts arranged and proportioned? What, finally, is their ornamentation? All these are questions to which it is proper to reply with explanations human rather than geographical. But here again these different features have been combined in an analogous manner over stretches of country which frequently form small natural provinces and the study of which can never be completely independent of geographical considerations.

How far does it extend? (geographical limits).—The wooden house extends as far as the forest. It is sufficient to say here that the steppe is a zone of middle Russia where forest growths first become sparse, then disappear to give place to the Gramineae, Cruciferae, Labiatae, Umbelliferae, Liliaceae, and Compositae which form great herbaceous covers beneath which lies the rich *tchernoziom* (black earth). In the steppe appears the *isba*, built of dry earth, of clods of turf, or of loam, often entirely covered with a dazzling white layer of lime (Fig. 44).

Thus geography explains in an entirely natural manner what an exact and well-informed traveler in Russia noted:

> Most of the *isbas* of the steppe are built of turf—yes, in this paradoxical Russia, where in places the wood overruns everything, a part of the rural population dwells in huts of turf and warms itself . . . . with straw! This is the way our amateur architects proceed. They plow parallel furrows which merely split the layer of turf and roots which covers the steppe. With a spade they then cut up these grassy strips and thus obtain pieces about 11 to 13 inches square by 2 to 3 inches thick (30 to 35 centimeters square by 6 to 8 centimeters thick). First they dry them; then placing them close together, grassy side down, they make walls about 27 inches thick (70 centimeters) and 7.5 feet high (2 meters and 50 centimeters). Then upon these walls they fit slender beams which form a roof frame with ridge pole perpendicular to the street. On these rafters they spread branches and on the branches a double layer of turf. When the whole building is well dried they daub the walls within and without with clay and whitewash them. Such is the typical *isba* of the steppe; the differences that are found come from the larger or smaller quantity of wood used in the construction.

Also in the marshy plain of north Germany, dotted with lakes and peat bogs, the wooden house disappears, to be replaced, now by houses with walls of burnt brick, now by houses with walls of clods of peat and of wickerwork as in the *Moorkolonien*.[1]

In northern regions the forest ends, and wherever sedentary populations have established themselves these dwell in houses in which wood plays only a very secondary rôle. From this point of view the Iceland farmhouse is entirely typical: the walls of the house are built for the most part of clods of turf and earth and only the front of the house is faced with boards.

[1]For an interesting study of the houses in the *Moorkolonien* see G. Blondel, *Etudes sur les populations rurales de l'Allemagne*, p. 133.

In all western and central Europe the forest is limited on every side by enormous strips of open land, or by island-like clearings, and here rise everywhere infinitely varied types of houses which contrast in their whole exterior form and in their character with the wooden house.

Up to the very foot of the forest, and, so to speak, joined to it, is a region which is not yet entirely deforested, like all of the Swiss plateau up to an altitude of 2,300 or even 2,650 feet (700 or 800 meters). There the rural house is built of stone and wood in variable proportions.

Another boundary of the forest is the limit of high altitude where trees no longer grow: above the forest is the *alp*, with its pastoral and nomadic life of summer. Where the *alp* is extensive is found a hut of stone — the chalet in which cheese is made — like the chalet of the Bernese high mountains or the *Sennhütte* of the canton of Valais. The same fact occurs again in the Department of Cantal. Above and beyond the forest we find the upper pasture-ground and the *buron*, which is in general a structure of stone (Fig. 26).

Jean Brunhes

FIG. 26. IN THE CENTRAL HIGHLANDS OF FRANCE: A BURON OF THE DEPARTMENT OF CANTAL

This stone structure (walls and roofs of stone) surrounded by stone walls, is a temporary summer dwelling, standing at an altitude of about 4,900 feet (1,500 meters) at the foot of the Puy Mary. It is used for the manufacture of cheese, and is called a *buron*.

Toward the south of Europe, finally, the northern forest ceases altogether. It ends still more definitely than toward the west, and the wooden house stops also at the edge of that Mediterranean world whose geographical types of human construction will be examined a little later.

What becomes of it? (*geographic future*).— The forest, in spite of reforestation — attempted with so much energy and method in certain countries, notably Switzerland — is dwindling and becoming impoverished. Besides the necessary clearing which

Isaiah Bowman

FIG. 27. THE STONE DWELLING BEYOND THE FOREST LIMITS

Straw-thatched stone huts of mountain shepherds in their winter homes in a deep valley at Soncor, eastern edge of the Desert of Atacama, Chile.

we have looked upon as the condition of historic settlement in our countries, there has been too often an unrestrained and destructive utilitarian clearing, an important fact which will have to be considered at length as a phase of destructive economy.

Besides men, the forest has many other enemies, such as the avalanche or inundation; but the most serious of all is fire. It would be very useful if a geographer, taking as a basis the known facts of the last half century alone, would make a study of the extent of forest that has been destroyed by fire even when it has been possible to fight fire with effective modern methods.

Going back only a few years, let us recall, during the single hot, dry month of August, 1904, the fires of the first days of the month in southern Norway and Sweden; toward the middle of the month, the fire in the forest of Fontainebleau and the

great fires in the forests of Silesia; toward the end of the month, the fires in Corsica and in the forests of British Columbia. Late in August, 1906, a serious fire in the forest of the Esterel cost the lives of several soldiers and destroyed at least 7,410 acres of wood (3,000 hectares); at the same period several forests in Savoy and several in Auvergne were also burning. Some days later, at the beginning of September, fire devoured the forests of Val Champex in the territory of the commune of Orsières (Switzerland) and raged likewise in the forests on the east shore of Lago di Garda.

In October, 1908, enormous clouds of smoke, coming from forest fires caused by dryness in the states of New York, Pennsylvania, and Michigan, swept over the cities on the banks of the Hudson. In New York this thick and suffocating smoke so darkened the day that it was necessary to turn on the electric lights at noon, and there was a distinct smell of burning wood and leaves. One of the numerous fires in the Adirondack Mountains spread over a width of four miles. Every hot and dry summer implies a diminution of the forested area, and it takes long years for the trees to grow again and the forest to be replaced.

The summer of 1911 was to a rare degree a summer of fires. Recall the numerous wooden houses, in the depth of the Canadian forest, which were destroyed by fire in July. In the month of June 8,000 houses of the city of Kirin, in Manchuria, were burned. In July "the red cock with wings of flame," as the people call it there, ravaged Russia and Siberia. In a single week it was announced that more than a thousand houses had been entirely destroyed and that 59 persons had been burned alive. At Basel, in the canton of Aargau, at Suhr, at Fribourg, at Selzach (Solothurn), fire devastated much property during the months of August and September, and on the 17th of August the large Italian village of San Bartolomeo, close to the Ticino frontier, fell a prey to the flames.[1]

In July, 1911, there were extensive fires in the great forest area of North America, both in the United States and in

[1]For other facts, see "The Forest Fires of 1910," *American Forestry*, November and December, 1910, Washington, and L. Morei, *La Question forestière en France*, A. Rousseau, Paris, 1910.

Canada, especially in northern Ontario. At the same time in France the forest of Fontainebleau burst into flames, and nearly 2,500 acres (1,000 hectares) were burned; the Argonne forest also caught fire.

Between August 12 and 20, 1911, the woods and thickets everywhere in Europe took fire; in France alone twenty or thirty places were affected: Saint-Germain-en-Laye, Rambouillet, etc. While the Belgian *fagnes* were burning over hundreds of acres, the pine lands of Franzensfeste in Tyrol were in flames and masses of forest in Switzerland were everywhere on fire — in the neighborhood of Locarno, in the communal forest of Abbaye (canton of Vaud), in the valley of the Conches, on Glishorn, on Grammont, in Vanil des Arches, etc.

During the first days of September, 1911, fire spread its ravages near Avallon, in the neighborhood of Chartres, in the forest of Vallussière (Var), in the forest of Chinon, in the peat-bogs of Puy-de-Dôme, in the forests of Pont-Guiraud at Saint-Pons (Hérault), in the department of Gard, Morbihan, Sarthe, etc.

Everywhere the dry trees are an easy prey to the burning cinders from locomotives; on the slopes which border railroad lines we even see the grass licked up and destroyed by creeping lines of fire.

The isolated wooden house and the village of wooden houses are subject to the same danger that the forest is. They may also be destroyed by fire.

The little village of Neirivue in the canton of Fribourg, Switzerland, was completely destroyed by fire three times in a little more than a century. In May, 1906, the village of Planfayon, also in the canton of Fribourg, was devastated. In August of the same year, the little village of Cleibe, in Valais, was swept away; only a single dwelling house was spared.

What has happened so often in Switzerland has happened in all European countries wherever the wooden house predominates, from Bulgaria (destruction of city of Kotel, near Sliven) to Scandinavia, where the largest cities such as Trondhjem have so often suffered from fire. On January 24, 1904,

the little town of Aalesund, the port of southern Norway, had three-quarters of its wooden houses devoured by a conflagration.

Now what is the result of this destruction by fire and of the constant menace which it holds for wooden structures? Sooner or later they give way, and stone or brick is substituted. In the Siberian forest which continues the Russian forest, Irkutsk, called to-day Irkutsk the White, acquired its new form and its surname only after it had been completely destroyed by fire. Likewise, Meiringen (Bernese Oberland), once destroyed, has been rebuilt of stone, and so again Neirivue and Planfayon. Governments, alive to the dangers of fire, make laws forbidding that new roofs be made of thatch or new coverings of shingles; little by little roofs that have been repaired, even in the very midst of the ancient territory of the wooden house, have been covered with tiles or slate. In America the most congested cities have fire laws requiring that all new structures shall be built of fire-resisting materials. Thus the geographical distribution of the wooden house, like that of the forest, becomes more and more restricted because of the ravages of fire.[1]

The house of the large city has been transformed still more quickly than the house in the village or small settlement. Nothing in Petrograd recalls the forest which reaches to its very gates.

This very brief outline of the geography of the wooden house in the northern forest shows us that, if geography is far from explaining everything in the house, at least the human habitation cannot be completely understood without an appeal to geography.

A similar study of the prevailing types of human habitations in the Mediterranean region would enable us to establish in the same way the relation of the house-type to the geographical surroundings.

Whatever may have been the earlier conditions of vegetation in the Mediterranean territory, however beautiful and numerous may have been the forests of the eastern shores of the

[1]See Raoul Blanchard, *L'Habitation en Queyras:* "The threat of fire hangs over these houses incessantly. The threat is often realized," etc. (*La Géographie*, XIX, 1909, p. 27).

Adriatic or of Mount Lebanon, however large may have been the rainfall in certain districts,[1] Mediterranean Europe to-day contrasts with the deforested Europe that we have just been considering, as a denuded Europe with a Europe that is clothed in green. The Asiatic and African countries that border on the Mediterranean together with the European peninsulas form a Mediterranean world which, by the serenity of its sky and the sharp severity of its mountainous setting, contrasts strongly with central, western, and northern Europe.

We cannot discuss here the relationships between climate, natural forms of vegetation, and animal and human life in this environment of the Mediterranean where so many kinds of human energy have developed with such intensity. Let us merely note that everywhere appear forms of vegetation composed of shrubs with evergreen foliage, bushes and plants that survive the dryness of the summer; they are the *garigues*, the *maquis*, etc. Let us recall also that everywhere men have striven successfully to transform the often steep slopes into terraced gardens — the *cultures en terrasses* — and that they have devoted themselves with a natural taste to the skillful cultivation of trees.

These small cultivated trees (orange, olive, mulberry, etc.) are generally planted at intervals, and they appear from a distance in the form of a light trellis, or else as if scattered in the form of little round spots close to the ground. They never give the impression of large, bushy masses, thick, and tall, and close together, such as that always given by the northern forests, whether they are seen from a distance or near at hand.

All about the Mediterranean rise chains of mountains or highlands with exposures of bare rock. Here again is the house of stone: in Spain, in Provence, in Liguria, and in Calabria, as in Sicily and Greece, at Jerusalem, at Tunis, and at Algiers. The stone house, by the very nature of the

[1] The best watered place in Europe is, in fact, to be found in the Mediterranean portion: Crkvice, at an altitude of 3,500 feet (1,100 meters), receives about 14 feet (4.55 m.) a year, and even reached a maximum, in one year, of almost 20 feet (6 m.) of water. See K. Kassner, "Das regenreichste Gebiet Europas," *Petermanns Mitt.*, L., 1904, p. 281. Again, in Switzerland, the best watered spot is Brissago, on the shores of Lago Maggiore, a little to the south of Locarno.

material used, is susceptible of much more capricious architectural variations than the wooden house. If we should make a general and systematic study of the stone house analogous to that which we have made of the wooden house, we should be obliged to consider the distribution according to regions.

1. In the Terra di Bari and in the Terra d'Otranto, *Apulia petrosa*, formed of a thin-bedded fissile limestone, the people build houses and shelters by arranging blocks of limestone in superimposed circles without even binding them with cement. To cover these round rooms they narrow progressively the diameter of the rings and place on the top a large flat stone. Sometimes the exterior form is that of a truncated cone, or rather, since they arrange two or three shelves on the outside, of several truncated cones placed upon each other; this is a *trullo*. Sometimes the whole structure is covered with a conical roof which is itself constructed of small limestone sheets called *chiancarelle;* this is the *casella*.

2. *Trulli* and *caselle* are strictly limited to the zone of sheet limestone.

3. On the other hand, we find analogous structures in the Balearic Islands, at Gozzo, or even in regions geologically entirely different, but where the constituent rocks are also easily cut into sheets (Ireland, Hebrides).

4. We must include in the same type of building ancient structures of uncemented stones, the ruins of which have often been described by archaeologists — the *talayots* of the Balearic Islands, the *nuraghi* of Sardinia, or the *pueblos* of New Mexico and Arizona.[1]

5. It would, however, be a mistake to consider the *trulli* and the *caselle* as primitive forms of habitation in Apulia. On the contrary, the region where these structures are the most numerous has been peopled only for the last two or three centuries. Where now stands Alberobello, the largest town of *caselle*, with 9,000 inhabitants, there was nothing at the

[1] G. Perrot and Chipiez, *Histoire de l'art dans l'antiquité*, IV, pp. 51–55; and Cartailhac, *Monuments primitifs des îles Baléares*. See also the discussion by Jean Brunhes of ancient *talayots*, and modern constructions of the inhabitants of the Balearic Islands called *barraccas* and *ponts*, in an article that appeared in the *Rev. des deux mondes* (November 1, 1911), entitled: "A Majorque et à Minorque, Esquisse de géographie humaine."

beginning of the seventeenth century but "a chapel in the woods."

As a matter of fact, whatever be the historical and archaeological interpretation accepted by competent scholars, one cannot but say with Bertaux:

> If the geographical conditions of Apulia do not suffice to explain the distribution of the *trulli*, they alone can explain their continuance. On the one hand, the *trullo*, the low wall of which forms the inclosure, furnishes a use for the stones which must be taken from the field. On the other hand, the irregular materials which can be picked up at one's feet would not lend themselves to the building of houses; wood for roofs becomes more and more rare as the last groves of oak give place to olive trees. All the peasants agree that the *trullo* is the most economical building. It is also the driest and the most healthful; the rain rolls easily over the *chiancarelle*, and the sun does not penetrate its thick walls. In fact, the interior of a *casella* of a well-to-do agriculturist is comfortable and attractive.

Before seeking to determine the historical relations of the *trulli* and *caselle*, it is wise to determine their relations to like structures elsewhere.

One of Bertaux's happiest observations is that which concerns the resemblance between types of construction belonging to different regions but made of similar materials (in this particular case, limestone rocks). We must always bear in mind the fact that the materials utilized by man bring about certain forms of construction, not because of their internal character, but because of their physical characteristics (hardness, strength, and customary forms). In Palestine houses without order or symmetry are crudely built of scattered blocks of the compact white limestone from Mount Hermon and of the black basalt from the Hauran. These rocks, so dissimilar in many respects, have the same durability and are readily available, rough-hewn for the builder (Fig. 28).

But the facts here set forth are not limited to the Mediterranean region. For example, in the Central Plateau of France, or, to be more exact, in Cantal, sheets of basaltic

[1]E. Bertaux, "Étude d'un type d'habitation primitive, trulli, caselle et specchie des Pouilles," *Ann. de géog.*, VIII. 1899, pp. 207–230. See also a more recent and well-illustrated work by Carlo Maranelli, *La Murgia dei trulli, un' oasi di popolazione sparsa nel Meggiorno* (*Scriti in onore di Giuseppe dalla Vedova*), Florence, 1908, pp. 107–142. Apropos of the population of Apulia, consult Theobald Fischer, *Mittelmeerbilder* (Leipzig and Berlin, 1906), under the title: "Ansiedelung und Anbau in Apulien" (pp. 204–215).

lava have covered the crystalline base. Thus the basalt from the ancient volcano of Cantal has spread over the region called Planèze, and the city of Saint-Flour is built upon the

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FIG. 28. MISERABLE LITTLE LOW HOUSES, LOOSELY CONSTRUCTED OF WHITE BLOCKS OF LIMESTONE AND BLACK BLOCKS OF BASALT

These houses belong to the village of Hadar, on one of the long and difficult caravan routes from Banias (Caesarea Philippi) to Damascus. In the foreground and especially on the left are slabs of Mt. Hermon limestone; in the background and on the right are sheets of basalt connected with the Hauran toward the southwest.

extremity of a promontory of this flow. Beyond the limit of the basalt and all about Planèze the surface is formed of a solid gneiss which separates in large blocks. The houses of Planèze and those of the surrounding border are very similar, for the blocks are of basalt. Man finds them equally suitable for his work and for his needs.

The larger prehistoric pueblos of New Mexico were built of locally derived extremely fissile rocks. In some cases the pieces are no larger than a man's hand, with the spaces between chinked with slivers of rock or with mud. These ancient walls are often found still plumb and perfectly faced (Fig. 29).

Richard E. Dodge

FIG. 29. ANCIENT PUEBLO RUINS IN NEW MEXICO

Evidence of the former presence of a storied building is seen in the weathered line in which the ancient floor timbers were supported. The wall alignment is still nearly perfect.

Richard E. Dodge

FIG. 30. ANCIENT STONE CONSTRUCTIONS IN NEW MEXICO

These ancient masonry landmarks were built to serve as a guide to water holes. They are now sharply inclined from the perpendicular through the action of landslips.

In some of the smaller structures less care was displayed. Rough stones, more or less flat, were built up almost like a house of cobs. Yet so well were the stones lapped that the form of the structure is still intact, even in some cases after the building has been split in twain by a landslip (Fig. 30).

FIG. 31. THE USE OF WOOD IN THE CONSTRUCTION OF STONE HOUSES

In some houses in the Mediterranean region the upper stories are extended and supported by the ingenious use of short pieces of wood.

The immediate neighborhood of the Mediterranean, however, is not all bare rock; if we circle its coast, we find a series of plains and lowlands—now immense rich alluvial regions like the plain of the Po, now small basins inset among the mountains, now simple deltas, now even muddy and marshy regions.

In these regions and in the humid areas the house is made of dried or baked earth, sometimes of mere mud (*adobe*); and though the small dwelling of loam of the *huerta* in Valencia (Spain), called the *barraca*, is covered with a slender and rather attractive roof with two slopes, the wretched mud house of the infertile plain of Sharon, at the other end of the Mediterranean, between Jaffa and Mount Carmel, is covered with a flat roof made simply of clods of earth resting on slender beams.

Though this dependence is in a sense very natural, yet it suggests such consequences that it is well to examine a little more closely a typical case of this geographical juxtaposition of the house of earth and the house of stone. Moreover, the stone house is generally built in part of wood.

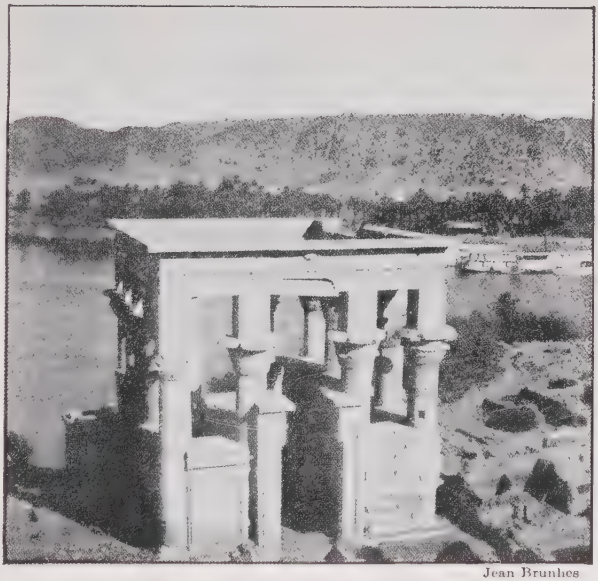
Often in the Mediterranean region a particularly skillful advantage is taken of small short logs such as those of the juniper tree (Fig. 31).

Since the wooden house has been considered only in a general way, and since it is desirable to illustrate here the

exact method to be followed in this phase of human geography, let us make a study of the characteristics of the wooden and the stone house — including form and construction — in the small natural unit area of the lower valley of the Nile (Lower, Middle, and Upper Egypt).

2. The House in Egypt: The House of Earth and the House of Stone

Present life is not considered of much importance in Egypt. True monuments are built only for the dead. Contemporary excavations find almost intact the ancient temples where the Pharaohs raised them twenty-five or thirty centuries ago (Figs. 32 and 33).[1] Fronting the Pyramids, the Mohammedan califs have erected the cupolas of their tombs. The god of Mahomet has raised up for the prayers of the faithful, massive, bold, and rich mosques, like the wonderful mosques of Cairo, splendid witnesses of Arabic art in its various periods.



Jean Brunhes

Fig. 32. The Kiosk of Philae

Figures 32 and 33 show two monuments of ancient Egypt; one, the kiosk of Philae, is without doubt the master-piece of harmonious elegance; the other, with its "forest" of 134 columns like those of the photograph, Fig. 33, was one of the hugest and most overwhelming edifices that have ever existed.

[1] Moreover, the excavations made in Egypt during the last twenty years have revealed a primitive Egyptian art which made use only of brick: "At the beginning of those far-away epochs," says Prince d'Arenberg, in his address on "Les Fouilles de la Compagnie du Canal de Suez en Égypte," before the annual public conference of the Five Academies, October 25, 1911, "unbaked brick was the only material used in the construction of monuments, and it was only much later that limestone and granite were adopted for temples and tombs."

But the Egyptian never thinks of building for his own use and comfort. He lives out of doors, in the open sunlight, the year around, and his house is only a shelter for the night. He

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FIG. 33. THE COLUMNS OF THE LARGE HYPOSTYLE HALL OF KARNAK

This illustration is placed here to bring into clearer contrast the plain and wretched houses of earth or stone in which the Egyptian fellahin dwell to-day.

must work in his field or in the field of another from January to December, without a day of rest, in this land that is never allowed to lie fallow.[1] He has no need of a shelter like that of the peasant of our northern countries for the long, gloomy evenings of the winter. He lives, in short, from hand to mouth. Since he has neither reserve nor provisions, and receives his daily pay of two piasters as he gathers the bundle of bersim for his ass and his buffalo, his dwelling does not need to be large enough to be used as a granary.

[1]See Jean Brunhes, *L'Irrigation dans la Péninsule ibérique et dans l'Afrique du Nord*, p. 360.

Furthermore, in the Delta all that would be necessary for constructing a solid dwelling fails him. He has neither stone nor lime; wood is a rare and precious thing which is reserved for the *saquich*, or plow. All that he possesses in this land of the Nile is the mud from which and on which he lives. This mud is, moreover, the most plastic of materials; it is worked without difficulty with a little water, and in this region where the air dries out everything, it hardens quickly and becomes as hard as clay. It is too easy and too cheap to build thus, for the fellah to have recourse to other means. Often in a small village he does not even take the trouble to mix some bits of straw with his clay and to make crude little bricks; much less will he think of sending for a *barbarin*, a man of Upper Egypt more skillful than himself, who can build a brick-kiln and bake the clay. These are caprices for great proprietors or the better business men of modern Egypt. Rather than all those improvements which involve extra trouble and labor, the fellah prefers the clay of the Nile which his wife can knead and the mud hut which his wife can build.

The Egyptian's house is thus reduced to the necessary minimum — four walls of pressed earth with a hole in one side for a door. The dimensions are irregular: neither the height, breadth, nor depth is fixed, and the one does not vary in fixed relation with the other.

As for the roof, that is a more serious problem; in fact, it is the great problem of the fellah's house (Fig. 34). In certain cases he gets along without it, living under the open sky by night as well as by day. This is rare, however, for he at least covers his house with palm leaves or with durra straw or sugar cane. But generally he makes a roof; upon one or two beams or a few branches he places a network of straw which he covers with mud. Thus the five walls of the house have the same color and an entirely identical appearance; they are of the same material as the soil upon which the fellah walks and on which he makes his bed.

In Lower Egypt the occasional rains are a further reason for the construction of a roof, and this roof must be built sufficiently strong so that the rain which softens the clay may not destroy it too quickly. The fellah has an additional

incentive to make a flat, solid roof, since this will serve him as his only granary — very rudimentary it is true, but still a place where he may store in small piles the cakes of manure that serve as fuel and the sheaves of straw that he has gathered (Figs. 34 and 35).

On the house of crude brick there is sometimes seen either a vault[1] (Upper Egypt) or a little cupola (Lower Egypt) of baked brick (Figs. 36 and 37). This roof is more solid, but it presents a smaller surface and is less useful as a granary. Care for the morrow being a secondary consideration with the fellah, in comparison with the needs of the present, he rarely has recourse to this method of building a roof; he prefers to allow

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FIG. 34. ROOFLESS HOUSES AT LUXOR

In the climate of Luxor, rains are much more rare than in the climate of Cairo; most of the houses of the fellahin nevertheless are covered with a roof; but there are some that are not.

the rain to destroy his roof many times rather than take so much trouble. The little cupola, for example, predominates

[1]The methods of constructing this brick vault are exceptional. It is, in fact, built without any supporting arch; simple cords serve to guide the workman, though the vaults have a span of at least six feet.

only in the small villages, or rather quarters, which the great proprietors of to-day build for their farm laborers (the *tamaliehs*) — villages which are called *ezbes*.[1]

From just below Assuan (Fig. 38), the plateaus of Nubian

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FIG. 35. THE CUSTOMARY FLAT ROOF LOADED WITH SUPPLIES OF FUEL

Pressed-earth houses of a little village near Sakha (Delta). See also the flat roofs loaded with supplies of fuel in Fig. 34.

sandstone approach nearer the river and are not so well dissected as to the south of Korosko. They appear as low, slightly

[1]In a study of the geographical literature of Egypt, it is curious to note to what a degree the fellah's house, the ordinary house, is passed unnoticed. Little attention is given to this topic in C. B. Klunziger, *Upper Egypt: Its People and Its Products, A Descriptive Account of the Manners, Customs, Superstitions, and Occupations of the People of the Nile Valley, the Desert and the Red Sea Coast, with Sketches of the Natural History and Geology*, Blackie & Son, London, 1878; or in E. W. Lane, *Modern Egyptians*, written in Egypt from 1833 to 1835, fifth edition (edited by E. Stanley Poole), J. Murray, London, 1871. A single passage of the latter, written over eighty years ago, shows that the fellah's house, unceasingly renewed, never changes: "Very few large or handsome houses are to be seen in Egypt, excepting in the metropolis and some other towns. The dwellings of the lower orders, particularly those of the peasants, are of a very mean description; they are mostly built of unbaked bricks, cemented together with mud. Some of them are mere hovels. The greater number, however, comprise two or more apartments, though few are two stories high. In one of these apartments, in the houses of the peasants in Lower Egypt, there is generally an oven (*furn*), at the end farthest from the entrance, and occupying the whole width of the chamber. It resembles a wide bench or seat, and is about breast-high: it is constructed of brick and mud; the roof arched within, and flat on the top. The inhabitants of the house, who seldom have any night-covering during the winter, sleep upon the top of the oven, having previously lighted a fire within it; or the husband and wife only enjoy this luxury, and the children sleep upon the floor. The chambers have small apertures high up in the walls, for the admission of light and air — sometimes furnished with a grating of wood. The roofs are formed of palm branches and palm leaves, or of millet stalks, etc., laid upon rafters of the trunk of the palm, and covered with a plaster of mud and chopped straw. The furniture consists of a mat or two to sleep upon, a few earthen vessels, and a hand-mill to grind the corn" (Lane, I, p. 25).

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FIG. 36. VAULTED BRICK ROOFS IN A VILLAGE NEAR ASSUAN

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FIG. 37. VAULTED BRICK ROOFS IN THE LITTLE VILLAGE OF EDFU

The vault is nowhere the only form of roof; houses covered with vaulted roofs are mingled with flat-roofed houses, or walls without roofs. This photograph of Edfu was taken from the top of the large pylon of the temple of Horus.

convex, broadly undulating swells, resembling huge tortoise shells, and are separated by slight depressions which end at the river. In general only the bank left uncovered by the fall of the Nile separates the plateaus from the river. The houses are very scattered and in general lie near the base of the plateau, or even on the plateau slopes, for the cultivable land of the plain is too valuable to have houses built upon it.[1] The houses, cubical in form with a single opening in front for a door, are usually built of stone because of the abundance of that material at hand. Sometimes the houses are even excavated in the rock itself.

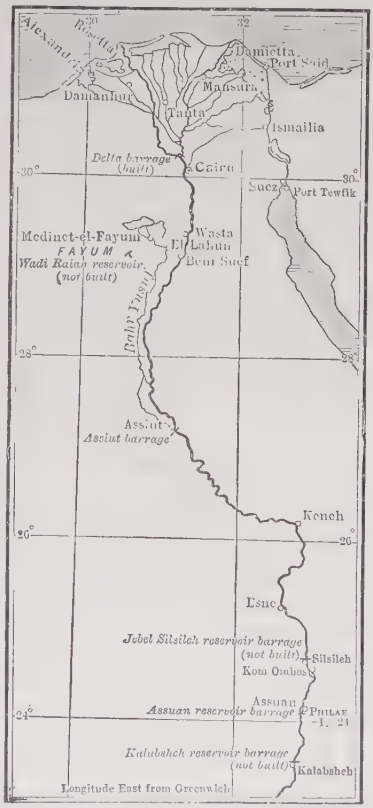

FIG. 38. GENERAL OUTLINE MAP OF THE NILE VALLEY UP TO KALABSHEH, JUST SOUTH OF ASSUAN

Thus in this country, with a similar population throughout, the house is of two types — in Lower Egypt, the mud or clay house; in Upper, or stony Egypt, the stone house.

In Middle and Upper Egypt the need of protecting grains and other provisions from the inclemency of the weather or from neighbors has led to the construction — always of mud which dries so quickly and holds so well — of fixed receptacles, such as those seen in Fig. 39.

In this study of Egypt we have not left as yet the valley itself of the Nile. We have not quitted the immediate banks of that great river which F. Schrader so well characterized as

[1] Between Edfu and Assuan, going up the Nile, the stony slopes approach the river yet do not border it, as do the banks of granite farther south between Assuan and Wadi-Halfa — that is, between the first and second cataracts. On this intermediate stretch below Assuan, some desire to be near the water and others to be near the rock. So we often see two lines of houses, one of mud (especially near the Nile), and the other of stone with brick vaults (beyond the cultivated zone and scattered in the desert).

"generous, marshy, deadly, fertile, unapproachable, creative, and destructive."[1] We have yet to consider the great oasis of Fayum, the water and life of which come from the Bahr Yusuf,

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FIG. 39. THE ENTRANCE TO A HOUSE IN THE FAYUM

Above the door are the provision "sacks," large receptacles of clay. View taken in the environs of Medinet-el-Fayum.

an affluent of the Nile. Fayum, fed by a river of relatively regular régime, is an Egypt with relatively great differences of level, though more "Mediterranean" in climate than is Egypt.

Everything is more trim, better finished, and we might almost say more artistic at Fayum. The house is of the same type as that of Egypt; but just as its approaches and annexes show more care, so the arrangement and details of its walls of pressed earth show a more developed taste and even art (Figs. 39 and 40).

When many detailed studies have been made of these representative and truly geographical types of human habitation, we shall be able to establish certain general facts concerning the form of the house, and to develop an exact classification.

[1] F. Schrader, Les Origines planétaires de l'Égypte (*Revue de l'École d'anthropologie de Paris*, XIX, 1909, p. 16).

Let us now consider several examples of these general facts.

From studies made in the countries of the wooden house, it seems evident that secondary buildings, such as the stable and granary, retain the characteristic features of the ancient type of construction, long after the earlier wooden house has for some reason been replaced by a house of another style. If the house is not replaced, it is often repaired, and a study of the successive alterations made in the course of its history would doubtless show us some interesting changes that reflect geographic conditions. In the Black Forest, shingles replace thatch; in the Fribourg Alps, slate or flat tiles replace the wooden shingles (Fig. 41). Even the walls of the house are partially repaired, and thus in small villages of north Germany, we see how bricks inserted in the middle of sections of wood replace the earlier loam.

Perhaps this piecemeal renewal of the parts of the house would explain the persistence of certain characteristics and especially of the geographical disposition of the house. Thus after the fire at Neirivue many of the new stone houses were placed upon the cellar walls that once supported wooden houses.

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FIG. 40. THE WALL OF A HOUSE OF PRESSED EARTH AT MEDINET-EL-FAYUM

The arrangement of the bricks and the little opening where the pigeon is seen, show a certain art of construction and even of ornamentation.

It seems, however, that in other places opposite customs prevail. "According to the local usage," says Émile Auzou in speaking of the villages of the peninsula of Guérande, "they do not rebuild fallen houses on the old site; they build at a distance without even utilizing

the fallen material so that the heart of the village is sadly filled with ruins."[1]

Certain secondary details of the form of the house, common

Pierre Hanssen

FIG. 41. TWO ADJOINING BARNS AT THE BUGNON (GRUYÉRE)

The new part of the roof continues the slope of the main part, but it is covered with tiles.

to otherwise wholly dissimilar and widely separated types of habitation, are to be explained in a similar way. In order to preserve their rice from rodents, the inhabitants of Imerina, in Madagascar, place large round pieces of wood in a horizontal position at the base of their rice granaries. These serve the same purpose as the slabs of schist which the Valaisans place at the four corners of the base of their *racarts*, and which are found also at the base of the *Stabbuhr* in Norway. We might even compare with these the granaries which certain peoples of the north build on piles to protect their provisions from the bears.

2. THE MATERIAL CHARACTERISTICS OF THE STREET AND OF THE ROAD

The most modest human establishment is accompanied by visible signs of travel and trade, in the form of small trodden spaces or beaten paths. At the door of the most wretched chalet or hut of the mountains ends a line marked on the

[1]Quotation from the volume by Émile Auzou, *La Presqu'île Guérandaise*, Plon, Paris, 1897, p. 316.

ground, by which men and animals ordinarily reach this tiny center of human life (Fig. 42).

As soon as houses are grouped, intercommunication becomes more intense and the street begins, more or less clearly marked and with a more or less regular space left between the dwellings. Whatever its character, it is simply an enlarged and more significant primitive trail, an evidence of human movement, transportation of goods, trade. In a small hamlet or village the crossroads formed by two primitive streets is but a big city square in embryo, or perhaps a local market, which when more developed we call the fair ground and with which—whatever its form or size—we always associate exchange.

Other geographers, and especially Ratzel and Hettner, have brought out the geographical significance of the most rudimentary types of roads: the footpath (*Fusssweg*), the mule

Paul Girardin

FIG. 42. THE TRAFFIC ACCOMPANYING SETTLEMENT

Chalets in the Glandon pass which opens a passage for the Maurienne in the Oisan group between the Belledonne chain and the Grandes Rousses mountains. These chalets are situated at 6395 feet (1950 m.). All about are the paths, visible signs of complex movement, scattered and uncertain: the less the lines of communication are improved, the less they are fixed.

trail (*Saumweg*), the wagon road (*Fahrweg*). But perhaps Ratzel has not sufficiently noted the relations between the character of the road, especially the perfected road, and the

geographical environment. Not only does the desert track, or the trail cut through the virgin forest, form part of the landscape and at the same time give it character; but the highway itself, by its construction, by its windings, by its slopes, by the material of which it is made, and even by its color, is a fact teeming with geographic interest. Even the city street — especially in its best developed forms — has geographical characteristics. The city of Toulouse, a city of bricks, is built upon the Quaternary gravel of a terrace of the Garonne. The stone that was lacking for the houses was also lacking for the street until recent improvements in means of transportation. Who does not envy and admire the streets of Funchal in Madeira, paved with smooth, basaltic cobbles, so hard and so closely fitted that the wooden, ox-drawn sledges used in place of the wheeled carts of other cities produce no dust! New cities and dead cities have streets which show or recall some of the characteristics of their material environment.

Finally, certain roads and transportation routes are, so to speak, ready-made in advance by geographical conditions. Man has had only to change slightly the most favorable parts. Under this head might be classed all roads over the snow and ice. These are doubtless the most economical solid roads for long distances, as is well illustrated in the winter lumbering sections of glaciated North America with its miles of ice plains in the cold season. Regions practically impassable in summer are ready highways with uniform grades or even horizontal slopes in winter.

It is also known how in Russia beyond the Volga, in all the Ural, in Siberia, and in Tibet, winter is the season of travel because at that season roads are available over the snow-covered lands or by icebound rivers and lakes. In the Alps, winter is the season for gathering wood and fodder. Mild winters with a deficient snowfall prevent the completion of the winter tasks, as does too early a spring.

In many forested and rugged countries, men make use of chutes to transport wood from the higher to the lower and more accessible slopes. Similar to this type of path is the very steep, partially graded road found on many forested slopes.

Almost all natural waterways, and all sheets of water, lakes or seas, which become waterways (*Wasserwege*), are physical features which man uses, without in any way changing their essential characteristics. These are certainly geographical facts; but as facts of human geography they are less characteristic and less important than routes of travel upon land. Travel upon the sea never leaves a mark upon the surface of the waters as clear or as permanent as even the fugitive trace of a camel's foot in the sand seas of the Erg.

The slightest improvement in the means of travel on land expresses itself by small surface facts, while improvements in marine travel leave the surface of the globe almost as unchanged as is the mass of the atmosphere by the passage of an aëroplane. Navigation and aviation put their marks most clearly on the earth at those points of contact between land and sea or land and air which are natural landing-places. Here ports and railways are developed as visible, persistent evidences of invisible water routes, or hangars stand as witnesses to air routes not only invisible but perhaps unknown.

One very important point in reference to land travel deserves emphasis. If a road or route is naturally adapted to only one means of travel, a change in the method of travel brings about a corresponding change in the character of the road. Means of travel then find an echo in geography; cart wheels have made their ruts in the streets of the dead cities of Pompeii or of Les Baux, or along the historic Santa Fé Trail, as they are making them in the streets of recent cities. To a much more marked degree steam traction and electric traction have brought into existence strips of road of a new type.

The development of steam as a motive power caused engineers to reduce the grades of old roads, which varied from 3 or 4 up to 6 or 7 per cent. The grades of the great international railways and the Arlberg and Mont Cenis lines do not exceed 3 per cent. The maximum of the Gotthard line grade is 2.7 per cent, that of the Lötschberg line and of the Simplon line (on the Italian side only) only 2.5 per cent. The grade of the broad-gauge road that crosses the Rocky Mountains at the highest level (11,600 feet) nowhere exceeds 4 per cent. Cog roads and funiculars may be built on slopes of

almost any degree of declivity; but they are mountain or city railways whose zone of action is very much restricted. Electric traction, on the contrary, has so wide a range that it has been introduced partially on roads where the trains normally run by steam (electric locomotives draw the trains from Brigue to Iselle and return through the 12 miles [20 kilometers] of the Simplon tunnel). Electricity is now used on some of the steep mountain roads of the Far West in the United States. It will become more and more the traction of the future, for it can be used over much steeper grades than can steam.

The form and character of the road are expressions of human geography that show the development of mankind as closely and as precisely as does the house.

Roman roads were above all built for strategic purposes and were destined to facilitate the sending of troops into all parts of the empire. The system increased as the Roman dominion increased. The first great road, the Via Appia, from Rome to Capua, was destined to assure the submission of Campania; the defeat of the Boii made necessary the creation of the Via Aurelia; and the defeat of the Gauls and the Germanic populations resulted in the construction of an important road system in the Alps and the basins of the Danube and the Rhine. Little by little *viae* traversed all the empire from the center of Spain to the heart of Egypt.[1] This explains why the Romans, desirous above everything else of quickness of communication and military transportation, took no account, in the construction of their roads, of the natural features of the land. Their roads are as far as possible straight lines. Artificial work is therefore very frequent, and includes bridges over valleys, embankments (*aggeres*) in the depressions of the soil, pilework, causeways, and masonry in marshy lands (as in a part of the Appian Way), enormous supporting walls along the sides of ravines, cuts through the mountains, or even tunnels. The Romans did not content themselves merely with smoothing the ground. In order to assure the solidity of the road, instead of *opening* it they *built* it.

The distinctive features of streets or roads, their arrangement or their number, are notations on the surface of the earth of the intensity and importance of the human relationships they serve.

If a structure, such as a monastery or a group of monasteries

[1]These lines and those that follow are taken from the *Lexique des antiquités romaines*, compiled under the direction of R. Cagnat by G. Goyau (Thorin, Paris, 1895, pp. 304–305; the article "Via" is signed G. M.).

(Lhasa in Tibet), becomes a center of attraction, paths and trails multiply about it and the road accompanies them, representing graphically the influence exercised by this center of pilgrimage.[1] In a general way the activity centering in every human establishment is indicated by these more or less definite, more or less established, lines found around it.

Both the main roads and the secondary roads of any well-peopled country are, in their general character, in the details of their plan, and in the state of their maintenance, reflections of a multitude of historic and economic facts.

Ratzel has many times pointed out the fragmentary character of the first short railroads in any region. This fragmentary character is common to all roads; and it is doubtless in the first stage of development of a new form of communication that the influence of local geographical conditions upon man is the strongest. Take for example the valley of Visp at the end of which stands Zermatt, and which is to-day traversed from Visp to Zermatt by a railroad. That valley offers us, from the point of view of the road, a typical case of interrupted communication. A strip of wagon road exists from Saint Nicholas to Randa which is not connected with any larger road system. At each end this road runs into paths wide enough only to accommodate the passage of a mule.

Railroads were first built in short, disconnected sections. In a recent lecture Paul Girardin, speaking of the early history of railroads from 1828 to 1832, called attention to the fact that these lines were first built in England, by the joining of two elements, the rail, projecting or hollowed, whence the name "roads with ruts," and the locomotive, a Watt steam engine placed upon wheels and made movable. The tubular boiler definitely substituted mechanical traction for traction by means of horses and, because of the greater speed obtained, it allowed travelers to make use of a means of transportation which in the beginning seemed suited only to the carrying of merchandise, and particularly to the movement of coal from the coal fields which were then just beginning to be opened up. But for a long time the future possibilities of this mode of locomotion were not perceived, and as keen a statesman as

[1]See J. Sion, "Le Tibet méridional," *Ann. de géog.*, January 15, 1907, p. 44.

M. Thiers could speak, in the Chamber of Deputies, of railroads as "playthings." This word, which seems ridiculous to us, is explained if we go back to the time when it was spoken. What railroads were built or under construction in Europe in 1828–29? There were lines from Paris to Saint-Germain and a little later from Paris to Versailles, from Berlin to Potsdam, from Nuremberg to Fürth, from Brunswick to Wolfenbüttel, from Naples to Portici, from Petrograd to Tsarskoe-Selo — every line uniting a capital to a royal residence. Was it not natural that they should seem only "playthings," just as to-day some cogwheel railways, engineering masterpieces though they be, play no economic rôle because they only make mountains accessible as playgrounds?

Finally, every inhabited area in which little or no effort has been made to mark out roads is an evidence of a people politically or economically backward.

In the interior of the island of Crete roads barely exist; the groups of human beings along the shore carry on a coastwise trade by sea, but it fails to meet the needs of this isolated land as a whole.[1] In the Pripet marshes (Russia) certain small centers of human occupation communicate with each other only by means of boats. Here, in the midst of Europe, some 60 or 70 miles (a little more than a hundred kilometers) from great industrial centers, is a region so primitive that men do not even know the use of the watch or of money.

[1] "To my great regret I had not time to visit the interior of the island, as I had done in 1857; but, according to all I have heard, if I could have allowed myself the excursion that so strongly tempted me, I should not have found there the surprises which, it seems at first glance, I should have had a right to expect. The island has not even a suburban railroad for either of the two capitals — Canea and Heracleion. It has no more well-built carriage roads than it had at the time when the luxurious and boastful Véli Pasha, whose guest I have been, had constructed at great expense, on the outskirts of Canea and Candia, the beginnings of some excellent macadam roads. In his carriage he used to take his European visitors out for one or two miles (3 or 4 kilometers); on their return to the west these visitors lauded the progressiveness of the reformer-pasha; but he would have been very much embarrassed if one of these visitors had asked him to go a little farther along the way. After the sixth or seventh measuring post (there were kilometer posts — I saw them), the great macadam road ended abruptly. It was continued by a vague trail, or a mule path. These charlatan tricks are no longer the fashion; but the state of the roads is scarcely more advanced than in the time of the Turks. Between the three chief cities of the north coast, Heracleion, Rithymno, and Canea, there are no easy means of communication — for the transportation either of people or of merchandise — except by sea, and no one of these cities has a port where steamboats can enter. When the weather is bad, one cannot, in these strange harbors, disembark passengers or unload freight. Relations are almost entirely interrupted for several days, sometimes for several weeks" (Georges Perrot, a letter dated from Heracleion, May 11, 1907, and published in *Journal des débats*, May 23, 1907).

3. THE CHARACTERISTIC ASPECT OF THE HUMAN ESTABLISHMENT: GEOGRAPHICAL TYPES. EXAMPLE: THE VILLAGE-TYPE IN EGYPT

Houses and streets joined in varied combinations form all the collective groups, from the hamlet to the great city. Ratzel has well noted the different historic modes of these agglomerations, especially in the Germanic countries:[1] *Hof* and *Gehöfte* (small isolated farm or large farm, equivalent to the royal villa or the chateau with its complement of houses of the "villagers," like that of Époisses, Côte-d'Or), *Zinken* (houses on the slopes of the hill or along a *thalweg*), *Weiler* (hamlet), *Marktflecken* (market town for fairs), *Landstadt* (city which lives from and for its rural environs), etc.

The true originator of this study of human groupings is J. G. Kohl, who published *Der Verkehr und die Ansiedelungen der Menschen in ihrer Abhängigkeit von der Gestaltung der Erdoberfläche*[2] in 1841. This work is the product of a very original creative effort. Since antiquity all the books treating of countries and cities have spoken of geographical position in relation to the concentration or increase of population, and of the physical limits of peoples as well as of human establishments, but they have not treated of these things as the end and object of special and systematic investigations. It is in this book that we find for the first time a comparative examination of *Residenzstädte* (pp. 15 ff.), *Badeplätze*, *Wallfahrtsorte*, *Kirchdörfer*, *Tempelstädte*, etc.

It is well first of all to bring out the peculiar physiognomy of the settlement which truly represents the type of a region. We have already considered the house type. It is equally important to study the village type or the small-city type. Their essential characteristics are clearly seen through a study of the following illustrations in the text:

Fig. 43: A village of the upper Alpine valleys: Saas-Grund (5,125 feet) in Switzerland.

Fig. 44: A village in the southern steppes of Russia.

Fig. 45: A small town along the shore of one of the lakes of Upper Italy: Salò.

[1] See Ratzel, *Anthropogeographie*, II, pp. 410 ff., and Raveneau, "L'Élément humain dans la géographie," *Ann. de géog.*, I, p. 333.

[2] Buchhandlung, Arnold, Dresden and Leipzig, 1841. See also J. G. Kohl, *Die geographische Lage der Hauptstädte Europas*, Leipzig, 1874.

Fig. 46: An *aoul* of Daghestan (the eastern Caucasus) (p. 120).
Fig. 47: A small village in Palestine near Bethlehem (p. 121).
Consult also the illustrations of the village types of Suf and of Mzab (Chap. VI), and notably those of the small towns

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FIG. 43. A VILLAGE OF THE UPPER ALPINE VALLEYS: SAAS-GRUND, 5,125 FEET (1,562 m.), IN SWITZERLAND

Chief place of the valley of Saas (Valais). Village of wooden houses with basements of masonry and roofs of wood. The village is both aligned and massed at the foot of a cone of detritus, on the sides of which spreads a checker board of small fields (on the right). The stone church with its bell-tower dominates and groups and centers, so to speak, the cluster of houses. To the right of the village beside the road, is a new house, one of stone, which is a hotel and expresses the economic evolution of many alpine villages.

so typical of Mzab which form such a striking geographical family.

The village type is in itself a geographical fact, both in the way it expresses the nature of a whole region and in the way its appearance and position depend upon its immediate surroundings. The picture of the village of Salò, on Lago di Garda (Fig. 45), might, for example, have a commentary like the following which applies to villages of all the wooded slopes bordering the lakes of Upper Italy:

Slopes almost entirely green, of two greens combined, one bright, the other almost black, forming from afar one somber color; on this background, in no sharp contrast, are light or

Paul Jaccard

FIG. 44. A VILLAGE IN THE SOUTHERN STEPPES OF RUSSIA

Near the bend of the Don. Representative village, with its houses of white-washed loam and large roofs of thatch. Some of the hedges and some of barn walls are of basketwork or wattling.

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FIG. 45. A SMALL TOWN ALONG THE SHORE OF ONE OF THE LAKES OF UPPER ITALY: SALÒ

On the shores of Lago di Garda. See the commentary in the text, pages 118, 120.

dark gray rocks. What does stand out upon these high and steep but harmonious slopes, what gives them life, what produces the opposition of shades and lines, is the white village against the dark background. Each village spreads horizontally along the hillside, breaking the main lines of the long slope, its dazzling points forming one level curved line, relieved and dominated by the vertical shaft of the bell tower. And as if to complete the harmony and to reproduce in exact miniature the deep, dark color scheme of the whole, each long white village is broken by dots of shadow formed by the

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FIG. 46. AN *AOUL* OF DAGHESTAN (EASTERN CAUCASUS)

Stone village of superposed flat-roofed houses, literally veneered and as if hooked to the steep mountain side. Entire village or *aoul* arranged for purposes of defense. (Koubatchi, northern slope of the eastern Caucasus.)

arcades, and the whiteness of each house is broken by the dark window openings.

Along the Black Forest and on the banks of the Neckar we see pretty and well-grouped villages with roofs of red brick, now built of loam with uprights of wood, now of brick, sometimes

of red sandstone, but always giving a reddish touch in the midst of a very green landscape. They are almost, with less

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FIG. 47. A SMALL VILLAGE IN PALESTINE NEAR BETHLEHEM

On the rocky slopes of the calcareous plateau of Judea, the small stone cubes of the houses, well cared for and well constructed, rise above the little fields in terraces. This group of houses is one of the villages that can be seen from Bethlehem on the side of a neighboring hill; but it resembles so many others: Beit-Safâfa, Beit-Sûr, etc., and nearer Jerusalem: Siloë, El Aziriyeh (Bethany).

brightness, like those great red scratches on the slopes of the wooded hills made by the quarries that furnished the sandstone for the castle of Heidelberg, the cathedral of Strassburg, and even farther up the Rhine, the minster of Basel.[1]

[1] A curious quotation from the *Rhin* of Victor Hugo will show us how recent is this critical desire to discern the nature and the rôle of the materials used in the construction not only of small villages (as is the case here), but also of cities and city monuments. On visiting Basel he is indignant that the cathedral (Münster) should be "painted with a red wash! Not only in the interior, as is right, but on the exterior, which is infamous! And, moreover, from the pavement of the place up to the highest tip of the towers, so that the two spires, which the architecture has made so charming, now have the appearance, in the day time, of two sculptured carrots!" (quoted by Antoine Saint-Marie-Perrin in his volume of the Laurens collection of cities famous for art, *Bâle, Berne et Genève*, Paris, 1909, p. 14). Sometimes the great discerning minds, especially the most illustrious of the naturalists—such as a Cuvier, and particularly an Elie de Beaumont—have clearly perceived and noted such relationships. "Lombardy, close beside Liguria, which is covered with marble palaces, erects only brick houses. The quarries of travertine made Rome the most beautiful city of the ancient world; those of coarser limestone and of gypsum have made Paris one of the most pleasant cities of the modern world. But Michael-Angelo and Bramante could not have built at Paris in the same style as at Rome, because they would not have found the same stone" (Cuvier, *Recueil des éloges historiques*, II, p. 325).

But while the village, always well grouped, presents a harmonious if not a very picturesque appearance, the house lacks embellishment and charm. The house is small with a two-sided, steep-pitched roof that extends only a few inches beyond the walls. To the traveler from Switzerland who remembers those magnificent roofs of the Swiss plateau, so ample that they seem not only to cover the house but to envelop and clothe it, the roofs of the middle plain of the Rhine and of the neighboring regions appear scanty. They are like our western clothing, cut just to fit, in comparison with the wide robes with which oriental peoples drape themselves. But here the house is hardly ever isolated; the unit which draws our attention is the village.

The Village Type in Egypt

Like house, like village. If the house is fragile and ephemeral, the village also is fragile and ephemeral. Nowhere else does one see so many ruins upon ruins as in Egypt, so many villages which, in the course of centuries, have grown one above another; even to-day the houses are so fragile that one could easily determine how short a time it takes for all the houses of a village to be renewed.

If the house is low and dull-colored, the village also is low and dull-colored. However, the houses have been massed upon slight eminences which remain above water in times of flood, and the accumulated ruins in one place tend always to increase the slight elevation. Thus the village rises like an isolated islet, and even the low houses grouped in it have a slight prominence which suffices to catch the eye, especially in Lower Egypt where nothing breaks the even line of the wide horizon (Figs. 48 and 49).

A village which has only this brown color of the dried mud of the Nile would naturally pass unnoticed on a plain entirely of mud. But this land rarely remains bare. It is usually covered with vegetation, and when this gives to all the visible landscape a rich, strong, green color, the village in contrast, and in spite of its dull tint, or rather it might be said because of its very lack of color, manages to make a spot which strikes the eye.

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FIG. 48. A VILLAGE-TYPE OF MUDDY EGYPT. THE COMPACT AGGLOMERATION OF PRESSED-EARTH HOUSES ON A SLIGHT EMINENCE OF RUINS

Village near Benha (Delta). An irrigation canal in the foreground

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FIG. 49. ANOTHER VILLAGE-TYPE OF LOWER EGYPT WITH THE SINGLE PALM TREE AND THE CUSTOMARY POOL

In the environs of Korachieh (Delta). The accumulations of ruins of these fragile villages cause the slight relief on which the present village is built. A pool is nearly always to be found beside the village in a small natural depression, which has been artificially enlarged by the removal of the clay necessary for the construction of the houses; on the right, a tamarisk and a cactus.

Even in the largest cities of Lower and Middle Egypt the houses are built of brownish bricks of slightly baked clay; in the Arab quarter of Cairo, called the *Muski*, the buildings

Jean Brunhes

FIG. 50. THE TYPE OF HOUSE CONSTRUCTION IN THE MUSKI, ARAB QUARTER OF CAIRO

This prevailing type of city house is, with greater dimensions and improved forms, of the same type as that of the small towns and of the villages. In the background are the minarets of the numerous and very beautiful mosques of this great capital of Arabic art.

are naturally taller and more solid than in the villages of the Delta, but their walls and their forms recall strikingly the houses of the latter (Fig. 50).

Against this background, so subdued in form and coloring, the slightest vertical line and the smallest bit of bright color take on a striking value.

The dirty white minaret of a very small mosque suffices to provide unity and to relieve the monotonous character of the Egyptian village. But mosques are rare in the villages, and not as in the countries where the church with its little bell tower is found sometimes even in the very smallest settlements, the mosque with its minaret is here confined to somewhat important centers. The mosque is not a temple, but a simple place of prayer, and its place may be taken by the *mirab*, a small area barely inclosed with a light wall of hardened earth,

a prayer floor separated from the surrounding ground very simply, like the floor where the fellah threshes his grain. For this reason the village in Egypt often has no mosque, and perhaps only two or three modern houses a little taller and a little whiter than the others, stand out amid the brown sun-baked mass.

In a village built thus, constructions which are merely details acquire a surprising importance. For example, in all Upper Egypt, the pigeon house, a quadrangular pyramid whitened at the top, becomes the prominent point in the village and, in relation to the house which man inhabits, rises like a monument.

In this great cultivated territory the harvests, which succeed each other without break, exhaust the soil, and the fellahin strive to compensate for this impoverishment with one of the rare fertilizers which is at their disposal — pigeon dung.

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FIG. 51. AN ALMOST MONUMENTAL ROW OF PIGEON-HOUSES AT LUXOR

Compare with the pigeon-houses the miserable human dwelling in the foreground rising only to the "ground-floor" of the pigeon-houses. This type of structure for the pigeons is frequent in all Upper Egypt.

That is why pigeons are treated with reverence and their dwellings cared for by men and prepared with more luxury than is put into their own houses. Beside the most wretched

huts of Luxor rises an almost imposing row of pigeon houses. (Fig. 51.) Elsewhere the pigeon house even takes on an architectural appearance (Fig. 52).

Toward the south the adobe village is replaced by the stone village, the village of the poorer section of the Nile banks. The meager and sporadic vegetation and even the houses have great difficulty in finding room in the midst of all these

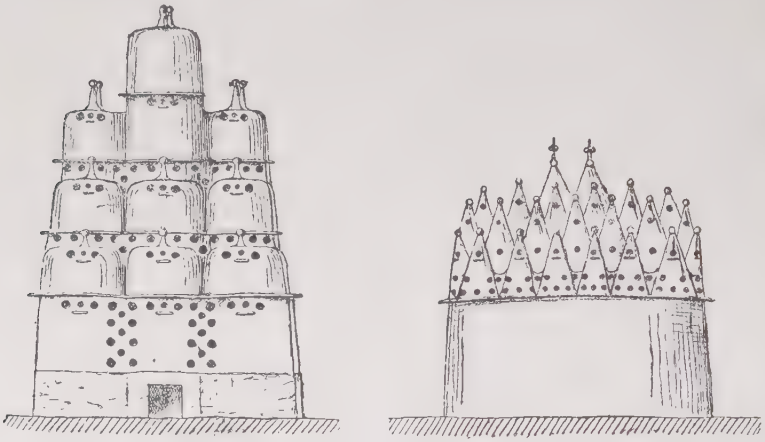

FIG. 52. TWO ARCHITECTURAL TYPES OF EGYPTIAN PIGEON-HOUSES

The type on the right belongs to the Delta; that on the left (26 to 33 feet [8 to 10 m.] in height), which sometimes appears in groups of four or five "edifices" of the same order, united or contiguous, is a form peculiar to the Fayum.

smooth and rough rocks (granite underneath with a superficial shell of sandstone) through which the Nile has had to break its way (Fig. 53). The limit of the adobe village is at Gebel Silsileh, where were in ancient times the first rapids of the Nile.

It is beyond Assuan, and especially from El Kalabsheh on, that the houses are built of stone and at the same time the village withdraws toward the mountain. It is barely seen behind the curtain of palm trees which faithfully follows the river bank; it is near the stone of which it is built, at the limit of the slender bordering plain and the mountain with its huge, dismantled blocks of stone (Fig. 54). While the mud houses of the earthen village rise in all Middle Egypt directly upon the alluvium of the Nile, whether in the middle of the bordering

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FIG. 53. THE BANKS AND GRANITE ROCKS AT THE BEGINNING OF THE FIRST CATARACT OF THE NILE

View taken from the end of the island of Philae (some of the monuments of which are to be seen in the foreground on the right), and looking toward the north. Beyond Assuan, underneath the plateaus of sandstone, projects the granite base, and it is granite, covered with a splendid and brilliant black patina, which borders and strews the first cataract.

Jean Brunhes

FIG. 54. TYPICAL VILLAGE OF STONE IN THE STONY PART OF EGYPT

View from the left bank of the Nile between Philae and Kalabsheh. On the left, the houses against the granite slope are built of the same rock, have the same color and blend almost completely with it.

plain or upon the edge of the river bank, the stone houses — though they can never be far from the river at that part of its course where it is shut in between two masses of sandstone or granite — seem at least to keep as far from it as possible. On the Nubian bank of the river rises the *saquieh* only, a specimen of the stone house which often remains unnoticed, a massive round tower which strikes the eye in this country where everything that men build for the needs of the present life, in the villages of stone almost as much as in those of adobe, is so shabby, so low, so fragile, and so ephemeral.

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FIG. 55. AT MEDINET-EL-FAYUM, THE BUILT-UP BANKS OF THE BAHR YUSUF

The houses are more elegant and higher; they rise from the very edge of a water-course more regular than the Nile, and are mingled with the trees growing there. All Fayum has a singular beauty and charm, the reasons for which we have tried to analyze elsewhere (see p. 108). It is indispensable to connect the ornamental details of the Fayum house as they appear in Figs. 39 and 40, and the appearance as a whole which the groups of houses present in this and the next illustration.

In the Fayum only, the agglomeration of houses has, like the house itself (Figs. 39 and 40), something more attractive and more harmonious. The trees are everywhere more numerous and more varied.[1] The main water course, the Bahr Yusuf, the emissary of the Nile, has a more regular régime and this has allowed the inhabitants to approach close to it. In short, the village and the little city of the Fayum, which are of the same type as the village and city of Middle Egypt, are more closely united to the river and to the entire *ensemble* of a more wooded

[1] Jean Brunhes, *L'Irrigation*, etc., p. 352.

landscape (Figs. 55 and 56). "The capital of the Fayum, Medinet, is in still closer contact with the Bahr Yusuf than Damietta is with the branch of the Nile. Formerly houses and a mosque were built even over the Bahr Yusuf, and these bridges of Medinet, covered with buildings, made one think of cities very far removed from Egypt, of Florence and of Nuremberg."[1]

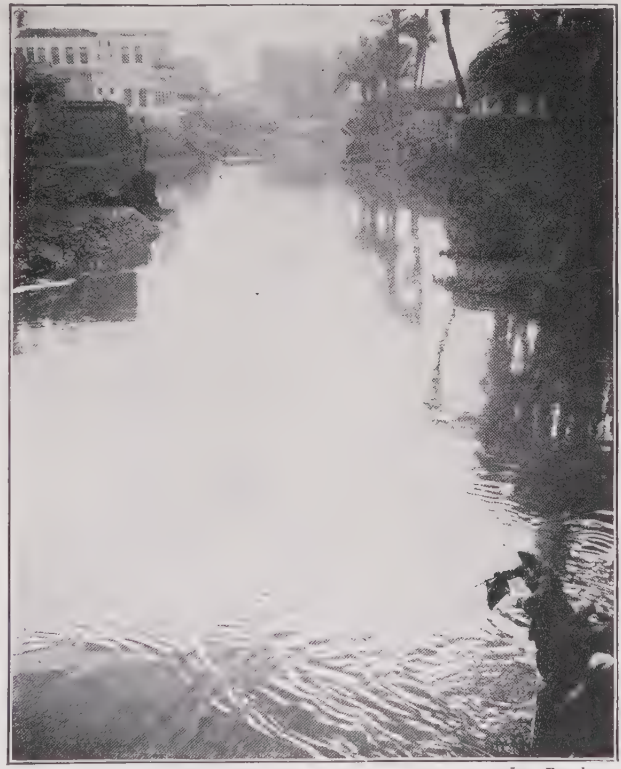

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FIG. 56. ON THE BAHR YUSUF AT MEDINET-EL-FAYUM

In the Fayum, the regular régime of the Bahr Yusuf has made it possible to build right up to the edge of the water. The trees are everywhere, more numerous and varied than in middle or upper Egypt, and the agglomeration of houses and trees has something more attractive and harmonious.

In the city or village of European countries the tree often disappears; it is swallowed up among the houses and can be seen only when one looks down upon the houses from a high place; even in cities of an oriental character and strewn with gardens, like Baktshi-Serai (City of Gardens), the old capital of the kahns of Crimea, which appears framed in dazzling cliffs of white chalk, the tree does not produce the effect that one might suppose. The houses are too high (even if they

[1] Jean Brunhes, *L'Irrigation*, etc., p. 351.

end in a flat roof) and, with the exception of the poplars, the trees form spots without giving prominent lines to the picture.

In Egypt, in the small human agglomeration, so colorless and so flat, the tree plays an extraordinary part. And as if to exaggerate as much as possible this part played by the tree, it is the date palm which is usually the associate of the fellah village. The inhabited huts are like low growths adorning the base of the tree, whose tall vertical trunk shoots up from the village with an added height, bearing aloft its light crest of notched leaves, a tuft of evergreen fringe which stands out against the luminous sky.

There are in Egypt, villages without a single palm tree or a tree of any kind; but they are few and more wretched than the others. Small flat cubes of clay, straight slender trunks of palm trees, green crowns which spread out far above the ground — these are the essential elements in the physiognomy of the Egyptian village (Figs. 48 and 49).

But what variety with only these elements! Now a single trunk with a single crown rising above an entire group of houses suffices to give to the whole an appearance of height and freedom. Now a group of palm trees close together emphasizes the effect which the single trunk produces. Now the palm trees are scattered in all corners of the cluster of houses and, casting their shadow over the entire village, resemble a screen set to moderate the blazing light of the sun. Now the palm trees, not content with rising here and there in the village, penetrate and multiply within it; each house has its palm or palms, and the trunk, instead of remaining stiff and straight, is bent and twisted and seems to draw near to the house and join more closely with men. This is the finest effect that the Egyptian village can produce. The trees everywhere present in the cluster of houses are closely associated with it, and from all these trunks, curving and intermingled, there is thrown upon the walls and roofs of clay a network of shadows which interlace and envelop the little buildings with that star of shade which falls from each lofty crown about the trunk that bears it.

But sometimes the palm trees in the village grow side by side instead of being scattered here and there, and then at

one side or the other of this mass of clay huts there is a more or less close curtain of tall straight trunks, more nearly parallel, through which pass great vertical lines of light, while the crowns rise in a broad, thick, undulating fringe terminating always in a delicate lacework against the sky. Then sometimes the date palm is not alone; here and there it is accompanied by great lebbeks, or tamarisks, or different sorts of acacias. Beyond Korosko it is not even the only palm that is found; from Nubia on we find the doom-palm, which shares with it "the glory of the palms" (Chevrillon); but the doom-palm is isolated and rare. It plays a secondary rôle in the landscape and especially in the customary appearance of the ordinary village.

On the whole the *type* is the anonymous agglomeration, the one which the tourist does not notice, the one which is not distinguished from any other but which for that very reason recalls and expresses all the others and has consequently a very great geographical value.

4. THE GEOGRAPHICAL LOCALIZATION OF THE HUMAN ESTABLISHMENT. SITE. DISSEMINATION OR CONCENTRATION. LIMITS

1. The Site

The application of a scientific method to human geography requires that we arrange the facts in series and then associate their most elementary forms, such as the isolated house, with their most complex urban forms. If we follow this method we shall find that the same natural facts which influence the location of the house also play their part in the location of the village and the city.

The site with reference to the sun.—In all the countries of central Europe man seeks the sun; his house faces, if possible, so that the rays of the rising sun strike it in front.

But, though the isolated houses in a widely open basin like that of Grindelwald or on the Swiss plateau can and do almost all face toward the sun, the problem is not entirely the same when houses are close together. The street then often plays a directing part and the façade no longer turns toward the sun but toward the road or the street. What characterizes even the city, that is, any important urban agglomeration, is the fact that — to the detriment of hygiene — the street by its

own direction and plan controls the orientation of the houses.

Between the isolated house and the large village is a whole series of transitions in which the grouped houses now depend for their orientation upon the agglomeration itself, or, on the contrary, remain indifferent to the street and the road and face in the direction most favorable to them (Figs. 57 and 58).

In other cases isolated houses on first inspection seem to be placed without any regard to sunlight. In the first section of the upper valley of the Sarine, which flows from south to north, the houses that are built on the two slopes of the valley face each other. But this phenomenon, at first surprising, is explicable. In high, narrow valleys with steep sides the houses generally face toward the river, that is, toward the valley floor; for, with the shadows thrown morning and evening by the

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FIG. 57. ORIENTATION OF THE HOUSE INDEPENDENT OF THE STREET

Seriers, small village of the department of Cantal (arrondissement of Saint-Flour). At the entrance to the village, the road becomes a street, narrowing down between houses which do not look upon it: the windows are on the sunny side.

neighboring heights, they may thus get a larger amount of light.

Though village houses seem often to take less account of the sun than do isolated houses, the village as a whole seeks the

sun. All through the Alps appears the contrast between the sunny slope and the shady slope, between the *endroit* (*adret* in the langue d'oc, *adra* in the Fribourg patois) and

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FIG. 58. HOUSES WHICH TURN THEIR BACKS TO THE STREET

The road reaching a small village of the Gramat *Causse* (France) expands into a vague crossroads before narrowing into a street. All the houses turn their backs to both crossroads and street.

the *envers* (*ubac* in the langue d'oc); the *endroit* is the sunny side and the *envers* is the shady side.

Maurice Lugeon published in 1902 *Quelques mots sur le groupement de la population du Valais.*

The influence of exposure [says he] is evident. Statistics . . . . show us a population of about 20,000 inhabitants on the left slope [of the upper Rhone Valley] and 34,000 on the right. It is true that in this particular case the right bank, being less steep, must lend itself better to habitation. It is certain that this topographical arrangement exaggerates the difference between the number of inhabitants on the two slopes; however, we can show that the influence of the sun is the chief cause of this evident difference. The district of Conches, or the upstream part of the valley, presents slopes almost equally inclined. Now the inhabitants of the sunny slope number about 3,000, while on the shady side live only from

700 to 800 inhabitants. All the villages, with two or three exceptions, are placed on the slope which profits most from the sun.[1]

On the whole, in latitudes where the solar heat is sparingly dispensed and especially in high altitudes, the urban settlement seeks the sun. Spreading skillfully on the sunny slopes, it tends to take that form which Raoul Blanchard calls picturesquely and accurately the "village en espalier" (a trellised village).

The site with reference to water.—Every human settlement, as we have said, must have water, and very often the distribution of men follows closely the water distribution. Sheets of water, lakes and seas, exercise an influence which is shown by the density of the population along their coasts and banks.

Upon the Swiss and Savoyard shores of the Lake of Geneva (Lake Leman) [writes F. A. Forel], we traced two parallel strips of 1.5 miles (2.5 kilometers) in width and of a total area of 96.5 square miles (250 square kilometers), the first along the shore, the second entirely within the interior. The total population of the section along the shore by the census of 1900 was 246,296 inhabitants, or 1,476 per square mile (570 per square kilometer); that of the interior section, 43,938 inhabitants, or 240 per square mile (93 per square kilometer). The lakeside zone was six times more densely populated than the rural zone. Subtracting from the first, the cities, Geneva and Lausanne, there would still be 650 inhabitants per square mile (251 per square kilometer); taking away further the cities, Thonon, Vevey, Montreux, Nyon, and Morges, there would still remain 401 inhabitants per square mile (155 per square kilometer).

Pierre Clerget, who quotes Forel's remarks in a study on the *Peuplement de la Suisse* ("Population of Switzerland"), adds:

The causes of this phenomenon are the attractiveness of the situation resulting from the mildness of the temperature and the beauty of the country—two reasons of attraction for foreigners—to which are added the facilities offered for the cultivation of trees and the vine and, in particular, the advantages of fishing and navigation, the latter being possible in Switzerland only on the lakes.

F. Bianchi, who has calculated the density of population in

[1]Maurice Lugeon adds these observations on social geography: "There is created, then, in this connection, a certain aristocracy, the aristocracy of the sun. The people on the right slope, more favored than those on the opposite slope, are generally better off, and consequently better educated. They have a certain disdain, almost contempt, these proprietors of the sunny side (*Sonnenseite*), for the people of the shady side (the poor of the *Schattenseite*). For those who know how to analyze fine shades in the sentiments of the population, Reckingen, that village on both sides of the Rhone, presents two real castes, not very apparent, but none the less real. This was pointed out to me by two friends who have lived in the little center. Thus, however democratic education may be, the facts of nature are such that they come themselves to disturb peace and to create distinctions."

the country encircling lakes Como, Maggiore, and Varese,[1] has arrived at similar conclusions. Over a territory of 1,640 feet (500 meters) around these lakes the density per square mile is 2,123 inhabitants for Lago di Como, 1,440 for Lago Maggiore, and 1,320 for Lago Varese, while it is only 526 for the entire province of Como.

The following table recapitulates in more detail the number of inhabitants per square mile:

	Zone of 1 to 1,500 Feet	Zone of 1,500 to 3,000 Feet	Zone of 3,000 to 4,500 Feet	Zone of 4,500 to 6,000 Feet	Zone of 6,000 to 12,000 Feet	Above 12,000 Feet
Lago di Como..	2,123	966	657	477	316	479
Lago Maggiore.	1,440	510	523	367	378	627
Lago Varese ...	1,320	774	676	839	1,178	559

One must have lived near these lakes in order to realize to what extent they are the means of subsistence, the center of local circulation—in a word, the center of life.

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FIG. 59. THE COASTS OF FRENCH PROVENCE

View taken from the Trayas toward the northeast. In the foreground are the superb red porphyries, so delicately cut, of the Esterel.

However, if we pass from there to Liguria, for example, we see still more clearly that habitations must have been concentrated where the mountains and the sea suddenly meet. Toward the sea alone can there be wide horizons and vast hopes, outlet and movement; all life, turning by necessity toward the sea, becomes organized near it.

[1] F. Bianchi, "Sulla distribuzione della popolazione nella provincia di Como," *Rivista geog. italiana*, XIV, 1907, pp. 79 ff.

FIG. 60. INDENTATIONS OF THE MEDITERRANEAN LITTORAL
The ancient little town of Éze and the seashore of the Maritime Alps (France)

In early times, as the *kjökkenmöddings* (kitchen middens) indicate, the shore especially attracted our ancestors because of the abundance of food cast up by the waves or because of the available supply of shellfish. Later the chief social influence of the water became increasingly due to the unlimited means of communication which it afforded. About the Mediterranean, Plato, let us recall, saw men distributed "like frogs around a pond."

Lévy

FIG. 61. THE ENTRANCE TO THE HARBOR OF CARTAGENA (SPAIN)

The heights serve as defensive posts and the interior bays as refuges and shelters.

It is only the marsh fevers and the caprices of the ever-moving dunes which can thwart this attraction and the concentration due to the proximity of the sea. In all latitudes the shores are chosen places for humanity.

If we travel through the coast regions of the Far East, if we enter those rivers that are wide as arms of the sea, we find a mass of humanity that is almost amphibious; the waters are literally crowded with fleets of junks; even in the interior of these lands this life, which shows so clearly the peculiar advantage of points of contact between land and water, is developed with an intensity that can scarcely be imagined (Figs. 62 and 63).

On the Yangtse, at its junction with the Han, three cities, Wuchang, Hankow, and Hanyang, face each other, forming

French Colonial Office

FIG. 62. THE POPULATED RIVER: THE MENAM AT BANGKOK

Sampans and rafts of bamboo

These two illustrations (Figs. 62 and 63) are taken from *Asie et Insulinde, Afrique*, Busson, Févre et Hauser.

FIG. 63. THE DIVINE RIVER: THE GANGES AT BENARES

Ghats or *stairs* of Benarés: Ablutions in the Ganges

one large triple city, the parts of which are almost joined by a multitude of junks. The city disappears, or, more exactly, is masked behind all this movement on the water and all these rows of little low dwellings on the bank.

Let a simple example from Norway, whose people get their living primarily from the sea, serve as a sort of recapitulation of all the chief phases of the rôle played by water in the location of habitations. The population is so distributed that a map represents it as confined almost exclusively to a fringe along the shore. The three illustrations (Figs. 64, 65, 66) reproduced by permission from a paper published by Hagbart Magnus of Bergen in 1898 show conclusively that on the coast (where the population is densest), as well as in the valleys of the interior (where dwellings are widely separated), water is the chief attraction. Between these two zones is that of the fjords, and here again the same cause acts as a control.

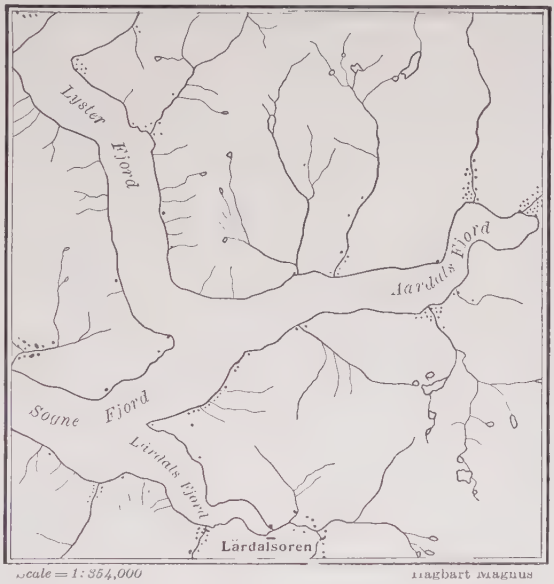

FIG. 64. THE GROUPING OF HABITATIONS ALONG THE FJORDS OF NORWAY

In the interior arms of the fjords, the rocky slopes are steep and often drop perpendicularly into the sea. The habitations are situated either on flat spurs, or principally around the mouths of watercourses. Habitations in groups are not to be found very far toward the interior of the region. Wherever a more important watercourse runs through a relatively large valley and has formed on the sides an alluvial plain (öre), more considerable agglomerations are situated which have in part the aspect of villages: Lärdalsören, for example.

The site with reference to topographical conditions.—Let us go down one of the Swiss valleys through which runs an Alpine river, like the Rhone. In that valley, where the wide floor spreads out between steep

FIG. 65. EXAMPLE OF THE TYPICAL DISTRIBUTION OF HABITATIONS ALONG RIVERS IN THE INTERIOR OF NORWAY, (THE RIVER ON THE LEFT IS THE SJOA RIVER; THAT ON THE RIGHT IS THE LAAGEN RIVER)

In the large eastern valleys, the farms are ranged along watercourses, separated by uninhabitable spaces. The road winds from farmhouse to farmhouse. Often the rows of dwellings are not situated exactly on the edge of the stream, but lie a little higher, on the side of the valley, the slopes here not being so steep as in the interior arms of the fjords.

FIG. 66. EXAMPLE OF THE TYPICAL DISTRIBUTION OF HABITATIONS IN THE COAST ZONE OF NORWAY (NORTH OF BERGEN)

This portion of the coast region is much cut up and very uneven; sheep-back rocks, crags which recall the Schaeren, and marsh. Radö island is a very characteristic small hilly region. The habitations (which are shown by black dots as in the two preceding diagrams) are scattered irregularly according to the conditions of relief. In this zone, along the Norwegian littoral, the habitations are relatively dense.

slopes, some natural features are to be found which take on an exceptional value. They are first of all the great alluvial cones of the affluents of the Rhone. In places these cones are thickly wooded, like that of the Illgraben (and farther down-stream that of the Bois-Noir between Aigle and Martigny); in other places, as illustrated above Brigue, they have already been conquered and exploited by man. Here they are entirely covered with grass, cut by lines of trees, and dotted with houses. In the second place, the floor of this valley is encumbered with curious mounds, evidences of an enormous preglacial landslide which for some time barred the course of the river. In the third place, there appear at Sion, on the right bank, promontories of schist which are geologically connected with the masses of the left bank.

All these topographical irregularities have offered natural places for habitation situated above the level of the river and of the alluvial plain which was annually flooded before the regulation of the Rhone, a work done during the nineteenth century; residuals of limestone covered by some traces of glacial material have furnished the site of Sierre and of Granges, as the residuals of schist have furnished that of Sion, and almost in the same manner as so many small cities or villages have been placed on the alluvial cones: Brigue, Visp, Gampel, Bramois, etc.

In all climates, the large and also the small cones of fluvial or fluvio-glacial deposits have certainly rendered the very greatest services to the inhabitants of mountain valleys (see the examples of the valleys of the Andes, Figs. 178, 195, and 204, Chap. VII).

All isolated elevations, whatever their origin or character, have a topographical value that appeals to men who seek to defend and fortify themselves. This is so true that cities built upon them come to resemble each other in spite of otherwise very unlike geological and geographical environments. Compare, for example, the advantage that man has derived from the twin peaks of the Liassic anticlinal axis of Sion with that of the two steep remnants of basaltic breccias in Puy-en-Velay; the photographs of these two localities,

placed together for comparison, are very expressive (see Figs. 67 and 68).

There is another topographical feature of high valleys which has naturally exercised a great attraction for human establishments, viz., the terraces.

Our great Alpine valleys present remarkable terraces due to glacial action. It is comprehensible that man has sought to occupy these flat spaces particularly favorable to cultivation. It is the terraces on the right side of the Valais which determine the altitude of all the villages on the slope. The most remarkable examples are those of Savièse, of Grimisuat, of Lens, and of Montana. These terraces limit the upper altitudes of permanent centers. When such floors are not very sharply defined, the inhabitants are inclined to go higher up in order to be nearer the pasture lands. Thus above Sierre we find Randogne and Mollens with their 300 and 285 inhabitants at an altitude of 3,937 feet (1,200 meters) and 3,527 feet (1,075 meters). It is, then, curious to note that from the administrative point of view, the communes, although formed of different centers, are much more extensive in the regions where the terraces are well marked. The physical fact seems to create this solidarity. Compare the contrary example of Savièse with its 2,049 inhabitants distributed in eight hamlets of which six have an average of 300 souls, while above Sierre we find centers just as close together, and often with a smaller population, forming independent communes. Here the terrace no longer exists, for the altitude and the slope separate the interests of the various groups. Each lives for itself. Consider the following figures, each of which stands for a distinct commune, and you will recognize this curious phenomenon: Randogne, 300 inhabitants; Mollens, 285; Miège, 379; Veyras, 110; Venthône, 446. When a fine terrace exists in the immediate neighborhood, as at Lens, the population rises then to 2,254.[1]

In the Connecticut River valley in Connecticut the houses, roads, and population are on the first terrace above flood level. The lower land is cultivated but not occupied, owing to the probability of annual floods.[2]

As means of communication are multiplied and improved, the advantage which results from proximity upon the same terrace, and even from the flatness of the terrace, decreases. The factor which comes into play is the number of inhabitants, the increasing dimensions of the agglomeration. A day comes

[1] Maurice Lugeon, *Quelques mots sur le groupement de la population du Valais, Étrennes helvétiques pour 1902*, Georges Bridel, Lausanne, 1902.

[2] See on Windsor, Connecticut, Martha Krug Genthe, "Valley Towns of Connecticut," *Bull. Amer. Geog. Soc.*, Vol. XXXIX, pp. 513–544, especially pp. 522–525.

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FIG. 67. THE CITY OF SION (VALAIS, SWITZERLAND) SITUATED ON THE SIDES AND AT THE FOOT OF AN ELEVATION OF SMOOTH SCHISTS FROM WHICH RISE TWO STEEP EMINENCES

The similarity of location of this city and of that shown in the photograph below is striking, though geologically and geographically the environment of the two cities is otherwise very unlike.

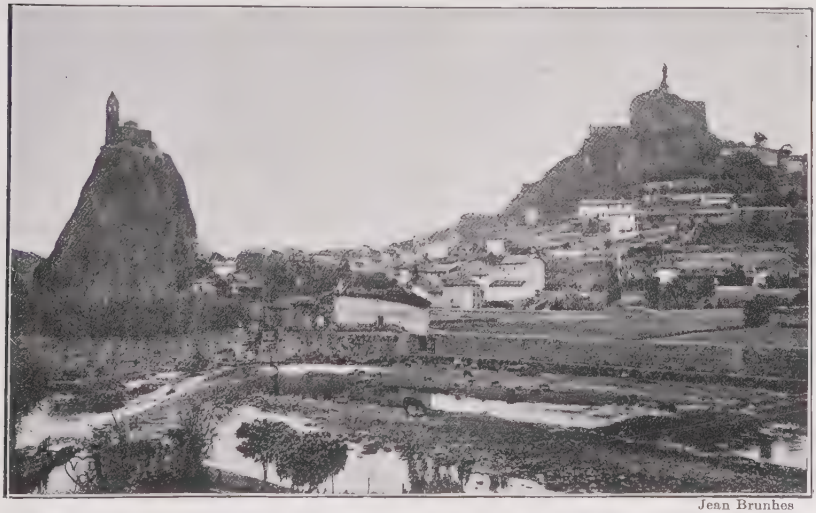

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FIG. 68. THE CITY OF PUY-EN-VELAY (FRANCE) ON THE SIDES AND AT THE FOOT OF AN ERUPTIVE ELEVATION WITH TWO PROJECTIONS

On the summits of the eminences in both cities are situated the castles, churches, etc. (or even colossal statues, as on the crag, Corneille du Puy, to the right in Fig. 68); these cities, both small capitals, have grouped themselves about peaks of defense or pilgrimage, thence spreading out into the surrounding flat areas.

when they seek and demand their independence. Since the work of Lugeon appeared, the four villages of the terrace and former commune of Lens — Icogne at 3,455 feet (1,053 meters), Lens at 3,806 feet (1,160 meters), Chermignon at 3,832 feet (1,168 meters), and Montana at 4,048 feet (1,234 meters) — have become four independent communes. Examples of villages or small cities built on large Quaternary terraces are Broc (in the Gruyère, canton of Fribourg) and Saint-Gaudens (chief town of an *arrondissement* of the Haute-Garonne in France).

The site and restrictive conditions.—We have seen how far certain facts such as the sun, water, alluvial cones, terraces, etc., act as favoring conditions. Other facts, and in special cases even those just mentioned, are restrictive in their influences on the establishment of human habitations.

Destructive floods in the valleys of powerful unembanked rivers, such as the Rhone formerly was, prevent men from locating their center of habitation in the low parts of the *thalweg*, and this restrictive factor emphasizes the influence of the slightest topographical irregularity. In all humid regions men have had to avoid lands swollen with water or strewn with stagnant pools. Even in temperate latitudes habitations have had to be placed on dry tracts to avoid the dampness of the flats.

In certain cases the wind also makes impossible permanent human habitations. In the upper valley of the Reuss rages the *fochn*, that hot wind so terrible in its effect, particularly in the springtime. The villages have therefore sheltered themselves from the *fochn* by locating in the lateral valleys. A. de Foville in his introduction to the *Enquête sur les conditions de l'habitation en France* has an excellent passage on the part played by the wind.

Avalanches constitute a periodic phenomenon, recurring so frequently in some high mountain valleys as to form danger zones avoided by man.

Charles Biermann has studied very carefully the restrictive influence of avalanches upon human establishments in the higher portion of the upper valley of the Rhone, which is called the valley of Conches. In traveling through this

valley one notices along the road frequent crosses set up to mark places where one or more unfortunates have met death under an avalanche. The most serious catastrophe was that which annihilated the village of Obergestelen, February 18, 1720. An avalanche roaring down from the mountain heights toward the west leaped over the intervening forest and demolished a part of the village. Reaching the Rhone the avalanche blocked the course of the river, causing a flood which overwhelmed another part of the town; all that remained standing was destroyed by the flames spreading from the fires just lighted by the housewives in preparing the evening meal. Out of 200 inhabitants 84 perished from one or the other of the three scourges, and 600 head of cattle were lost. Later when the village was beginning to rise from its ruins, a new avalanche from a different direction demolished it again.

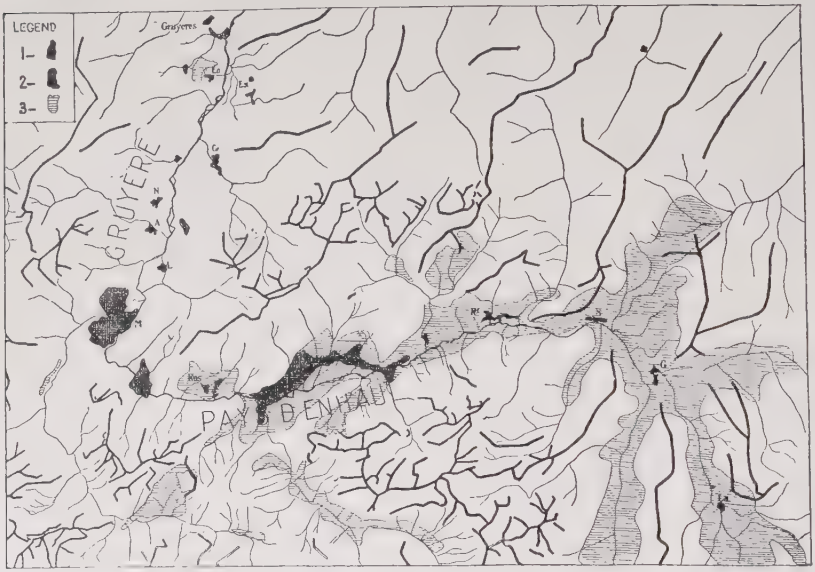
However, villages are not continuously threatened by avalanches. There is danger only at certain times of the year, after heavy falls of snow or when the *fochn* blows too violently at a time of thaw, or again when abundant rains cause the slipping of layers of snow.

In some places villages have been huddled together between two avalanche zones so that avalanches pass them by. Sometimes also they have sheltered themselves beneath great forests, some of which have been "placed under a ban" to assure their conservation. Unfortunately, in order to profit from these seemingly inutilized properties, sheep and goats are pastured on them and these destroy the young growths. Thus the forest is but slowly reproduced; the old trees disappear little by little and what few remain no longer form sufficient protection for the village.

Efforts have been made to renew the forests. A Zürich geologist, Escher von der Linth, left 15,000 francs ($3,000) for that purpose to the commune of Göschenen. This sum was employed in the construction of small walls of stone without mortar in the shelter of which were planted larches and small firs. In other communes similar work has been undertaken. But the peasants most often content themselves with arranging their chalets and their villages so that the avalanche may pass above the roof without meeting with obstacles.

2. The Dissemination or Concentration of Human Establishments

From this dependence upon favoring and restricting conditions, there results a very unequal distribution of men and of



Scale = 1:271,000

Fig. 69. The Distribution of Permanent Habitations in the Upper Valley of the Sarine (after Hanssen)

1. Houses agglomerated into villages. 2. Zones of little hamlets of 8 to 10 houses. 3. Regions of isolated habitations.

Reading up the stream from the plain of Bulle, lying north of the map, we have Gruyéres, 2713 ft. (827 m.); En = Enney, 2408 ft. (734 m.); Est = Estavennen; Gr = Grandvillard, 2467 ft. (752 m.); N = Neirivue; A = Albeuve, 2533 ft. (772 m.); L = Lessoc; M = Montboven, 2625 ft. (800 m.); Ros = Rossinière, 3025 ft. (922 m.); C. d'Oex = Château d'Oex, 3150 ft. (960 m.); Rt = Rougemont; S = Saanen (Gessenay), 3382 ft. (1031 m.); G = Gstad, 3445 ft. (1050 m.); La = Lauenen, 4131 ft. (1259 m.). Beyond Lauenen lie the upper valleys.

There are three successive zones in the valley of the main water course; in the first, from the upper valleys to the basin of Château d'Oex west of Rougemont, are isolated habitations and only four tiny villages; in the second, from east of Château d'Oex to below Montbovon, we find zones of considerable extent occupied by little hamlets of from eight to ten houses; the third zone, from below Montbovon to beyond Gruyères, is occupied by large villages, quite crowded, in the midst of an empty country without hamlets or isolated houses. The hachured regions lying apart from the rest, especially in the lateral valleys, are oases lost in the wilderness of mountainous regions (the heavy black lines indicate ridges more than 4,921 feet [1500 m.] high). These oases are inhabited all the year.

human establishments in the different parts of the earth. Here we cannot study very closely the modes and causes of this distribution in each particular region. Pierre Hanssen has analyzed these facts of distribution in the upper valley of the Sarine, and has represented the results obtained upon the

topographical map of Switzerland (*Atlas Siegfried*, maps on the scale of 1:50,000 and 1:25,000).

He has not published his work *in extenso*, but he has given a résumé of it in the *Bulletin de la Société fribourgeoise des sciences naturelles*, and Fig. 69 is a reduced map, showing the results of his work in this region where the geographical influences are most manifest.

Taken as a whole, the most striking general fact presented by the map is that humanity in high mountains is distributed in isolated islands.[1]

If we take account only of houses and their grouping, we can distinguish in the upper valley of the Sarine three well-defined regions:

1. *In the first region* (region of the extreme upper valley) the dwellings are much scattered and rise in successive steps from

Pierre Hanssen

FIG. 70. IN THE UPPER VALLEY OF THE SARINE. THE DISPERSION OF ISOLATED HABITATIONS IN THE REGION OF THE UPPER STREAM

View taken near Gsteig; scattered and isolated dwellings and barns of the village of Saali.

the bottom of the valley to a rather high altitude upon the terraces of the northern slope. They are isolated farmhouses

[1] This phenomenon, which is pictured in detail on the map by P. Hanssen, appears also, in the form of several large "packets" of population separated from the rest of the valley, in the map of the population of Grisons which accompanies the following work: Ed. Brückner, "Über Karten der Volksdichte," *Zeitschr. für schweizerische Statistik*, 1903; H. Zivier, *Verteilung der Bevölkerung im bündnerischen Oberrheingebiet nach ihrer Dichte.*

with hay barns or stables attached or close by, and are situated upon the flat stretches which are large enough and fertile enough to allow cultivation. This is the case for the basins of

Pierre Hansson

FIG. 71. THE DISPERSION OF HABITATIONS IN A HIGH TRIBUTARY DALE OF THE SARINE

Several houses of the Turbachthal, some with barns attached, others with barns separate, but in scattered locations.

Gsteig, Lauenen, Gessenay, and even of Rougemont (see Figs. 70 and 71).

2. *In the second region,* the habitations are gathered together in little groups (hamlets) placed on narrow terraces, with a *center* on the main road. These centers are composed almost exclusively of private houses or those of tradesmen and merchants. This is observable in the region extending from Château d'Oex to Montbovon.

3. *The third region,* which extends from Montbovon to Gruyères, has dwellings gathered in villages with all their dependencies — barns, hay barns, stables. The fact that the valley is very wide but is readily overflowed by the violent floods of the Sarine explains the necessity for this arrangement.

Different influences have fixed the site of the habitations. There is a preference for the more sunny northern slope, and

here the houses rise to a higher altitude than on the southern side. They are built near springs, in the shelter of a curtain of forest protecting them from avalanches and falling stones, and, if possible, in the center of the property. They are always built upon the better lands, that is, upon the alluvial cones. Example: Les Moulins.

In the Fribourg valley, from La Tine to Gruyères, this is not so. There the valley is narrow, the bottom is dangerous, the terraces are steep, and the habitations are necessarily gathered together into villages where all advantages are concentrated. The houses of these veritable little cities are built of stone but still are often covered with shingles (Fig. 72), while the isolated and uninhabited buildings are all entirely of wood.

The sun, however, here claims all its rights and exercises all its influence. The more sunny left bank is the more

Pierre Hanssen

FIG. 72. STONE HOUSES OF GRANDVILLARD, IN THE REGION OF VILLAGES WITHOUT ISOLATED HABITATIONS

Grandvillard is one of those large massed villages of Gruyère in the valley of the Sarine, which suddenly seem large and appear as real little cities. The houses are of stone, with shingled roofs, which are extended over the entrances.

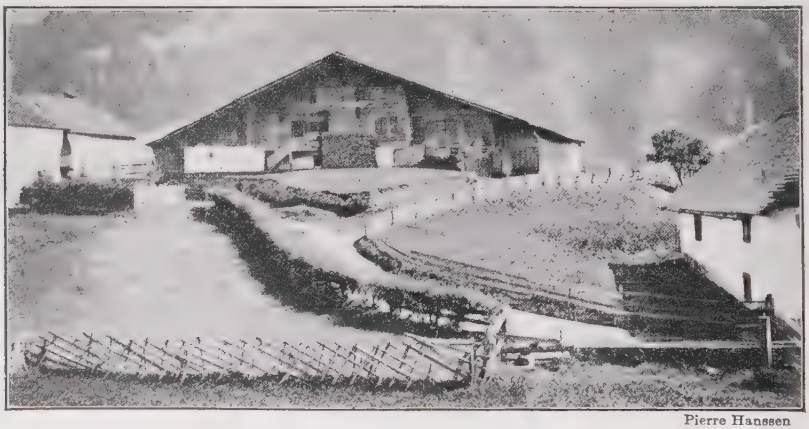
populated, so that everywhere, in the Pays d'En-Haut as in Gruyères, we find an orientation of the habitations toward the south — toward the sun, which is the dominant factor in the

question — and this is true even for the two rows of houses forming a village street (Figs. 73 and 74).

Hermann Walser has studied the facts of the scattering and grouping of habitations in a part of the Swiss plateau.[1]

The Bernese Mittelland is that part of the Swiss plain which is comprised in the canton of Bern, between the Jura and the Alps. In this region are isolated farmhouses (*Einzelhöfe*) and villages (*Dörfer*). There are six natural regions: the Seeland, the plateau of Frienisberg, highland Aargau, the Emmenthal, the transverse valley of the Aar between Thun and Bern, and the Bernese Uechtland.

The *Seeland*, which is the least elevated part of the Mittelland, seems to have been colonized first. The lake of Bienne distinctly separates two different regions of colonization. On the north bank are situated very ancient villages with narrow streets and stone houses (*Gassendörfer*). The south



Pierre Hanssen

FIG. 73. IN THE REGION OF HAMLETS: A TYPE OF DOUBLE WOODEN HOUSE, PLACED TO FACE TOWARD THE SOUTH

Double wooden house, at the Frasse, near Château d'Oex, in the second region [see page 148] of the upper valley of the Sarine.

shore of the lake has a different aspect. Bernese farmhouses, with great roofs overhanging the building on four sides (Fig. 24, p. 87), are scattered over a region rich in meadows and

[1] Dr. Hermann Walser, "Dörfer und Einzelhöfe zwischen Jura und Alpen im Kanton Bern," *Neujahrs-Blatt der litterarischen Gesellschaft Bern auf das Jahr 1901*. Reviewed by Pierre Hanssen in *La Géographie*, December 15, 1902.

woodlands. All along this shore, where formerly were at least eight lacustrian villages, we see to-day only two or three small hamlets. South of the lake of Bienne we enter a second

Pierre Hanssen

FIG. 74. LINE OF SCATTERED HOUSES FACING THE SOUTH

Near Gessenay (Saane), in the upper region of the Sarine, the houses turn their backs to the street in order to take advantage of the sunshine of mid-day.

depression, which is that of the Grand-Marais. This region is characterized by the organization of its villages. Around each village stretch meadows, potato fields, and vast grain fields. The meadows and the fields are arranged in long, narrow strips. The long house is the prevailing type, with its widely overhanging thatched roof sheltering the dwelling-house, the barn, and the stable. It is further to be noted how much trouble is taken to preserve in the new tile roofs the old form of the thatched roof.

The *plateau of Frienisberg* shows all the intermediary forms between the isolated farmhouse and the village of average size. Villages of about ten farmhouses are the most frequent; groups of from four to eight villages form a commune. Their name and their site indicate an ancient colonization. The wide, uncultivated valley extends from Fraubrunnen to Burgdorf,

a valley which in its principal features resembles the Grand-Marais. We find here groups of two villages so near together that it must be admitted that one grew up by colonization upon the edge of the other. These are *double villages* (*Doppeldörfer*) such as Rüdlingen, Alchenflüh, Fraubrunnen, etc.

Highland Aargau can be divided into two parts: (*a*) To the north extends a great plateau crossed by two large valleys. Where the valleys cross each other there are often small plains which furnish the sites of numerous villages. (*b*) To the south extends a rocky region furrowed by a large number of small valleys where isolated farmhouses predominate. Nowhere in the canton of Bern is there a more marked contrast between grouped and scattered habitations. Everywhere we find the ancient house of wood; almost all the isolated farmhouses are still roofed with thatch, while in the villages at the present time the tile roof predominates.

The *Emmenthal,* interrupted by countless small valleys, is the most uniform and the most characteristic region of isolated farmhouses in Switzerland. However, where the valleys have widened out sufficiently, a certain number of villages have been established and they might be grouped in three categories: (*a*) The very small villages, which are villages only in a certain sense, since they hardly correspond to the idea of a rural organization. They are situated in the very restricted flat bottoms of certain lateral valleys. Here are built the church, surrounded by a few houses, the priest's house, the school, a store, an inn, and sometimes also a few farmhouses. These villages are nothing else than the center of a commune with the public buildings which meet the needs of the district. They are like the *Kirchorte* of Westphalia and the *Kirkepladser* of Norway. (*b*) A second group of villages are the *Schachendörfer.* The *Schachen* (formerly communal pasture grounds) are the level and dried-up bottoms of certain wider valleys which were exposed to frequent floods. Old and new houses, small and large farm buildings, numerous small estates, houses of workmen, etc., form the mixed whole of the *Schachendörfer.* (*c*) Finally we have in the Emmenthal a certain number of true villages such as Rüderswyl, Ranflüh, etc.

The *transverse valley of the Aar*, between Thun and Bern, is a valley where villages predominate. But here and there may be noted a few small islands of isolated farmhouses, as for example on the Belpberg and on the plateau near Blumenstein.

The *Bernese Uechtland*, like the Emmenthal, is a region of active erosion, dissected by numerous valleys. High plateaus, however, are more numerous here than in the Emmenthal. The principal valley is the Schwarzenwasserthal, which, like the others, resembles a sort of canyon. The Uechtland is the second great region of isolated farmhouses of the Bernese Mittelland.

To sum up, the region of the north, that which is more unbroken and which is situated at the lowest level, is the zone of the Mittelland where the system of villages predominates, while the great tableland of the south, cut in all directions by narrow and deep valleys, constitutes the domain of isolated farms. On the other hand we find a mingling of these two types on the plateau of Frienisberg, in the Uechtland, and in the wide valley of the Aar between Thun and Bern.[1]

Let us take still another example somewhat farther away and involving a larger area. The contrast between the sparsely populated *highlands* of Scotland, and the *lowlands* where the average density reaches 337 inhabitants per square mile (130 per square kilometer), is well known. Sixty-five per cent of the inhabitants occupy 30 per cent of the total area. The different counties of Scotland have a density of population which varies from 10 to 1,080 inhabitants per square mile (4 to 417 per square kilometer). Apropos of each of the three great divisions, *Southern Uplands*, *Highlands*, and *Lowlands*, P. Privat-Deschanel investigates, analyzes, and shows in detail not only the irregularity of distribution of the inhabitants but also the different geographical causes, natural and human, upon which all these great facts of population depend.[2]

[1] See also, Everhard Schmidt, *Die Siedelungen des nordschweizerischen Jura*, Westermann, Braunschweig, 1909; and some interesting generalities in F. Nussbaum, *Die Täler der Schweizeralpen, Eine geographische Studie*, Bern, 1910, pp. 106–112.

[2] See Paul Privat-Deschanel, who published in the *Bulletin de la Société de géographie de Lyon* a study of the distribution of the population in Scotland, translated in full in the *Scottish Geographical Magazine*, November, 1902, pp. 577–587, under the title: "The Influence of Geography on the Distribution of the Population of Scotland."

We might enumerate and examine critically all the attempts that have been made to represent the exact distribution of population graphically or through maps. Only by an examination of the actual conditions of concentration or of dispersed population can we reach true conclusions. But where does concentration begin? Logically and strictly speaking, are there any isolated houses, *Einzelhöfe?* There are only houses more or less separated. Consult in particular the valuable article by Olinto Marinelli on the distinction between concentrated population and scattered population.[1]

One must have struggled against the difficulties which are met in trying to represent the facts of population graphically in order to appreciate at their full value the labors and the maps of Ravn or of Turquan, of Sprecher von Bernegg,[2] etc., and, in a direction that lies nearer to our own critical interests, a study like that of A. Hettner,[3] or attempts like those of Friedrich, A. Grund,[4] or E. de Martonne.[5]

In the light of the simple examples, carefully localized, which we have just given, it is easy to reach a conclusion such as Behm has already formulated (*Petermanns Mitt., Erganzungsheft*, No. 35), and which Ratzel has taken up with so much vigor: "The topographical map is the most exact and faithful expression in all its details of the distribution of population."[6]

[1]O. Marinelli, "Sulla distinzione fra popolazione agglomerata e popolazione sparsa, e sulla opportunità che nel prossimo Censimento e nelle relative publicazioni sia considerata separatamente ciascuna località abitata," *VI Congresso Geografico Italiano*, Venice, 1907.

[2]For the numerous attempts made, especially in Germany, see the article by B. Auerbach, "La Répartition géographique de la population sur le sol allemand," *Ann. de géog.*, V, 1895–1896, pp. 59–71 and 469–482.

[3]A. Hettner, "Über die bevölkerungstatistischen Grundkarten," *Geog. Zeitschr.*, VI, 1900.

[4]Read in particular the whole chapter entitled "Die Siedelungsverhältnisse der Gegenwart," and the map showing the density of the population, on pp. 160 ff., in A. Grund, "Die Veränderungen der Topographie im Wiener Walde und Wiener Becken," *Geog. Abhandlungen von Penck in Wien*, VIII, Vol. I, Teubner, Leipzig, 1901.

[5]*Recherches sur la distribution géographique de la population en Valachie, avec une étude critique sur les procédés de représentation de la répartition de la population*, Bucharest and Paris, 1903.

[6]One can conceive also how this *positive* way of visualizing the population allows one to analyze and discover the true relationships between the phenomena of population and facts of the physical order. See the excellent "geological" studies of the population of Sweden by Hoegbom, Ahlenius, and Per Stolpe, reviewed by Charles Rabot in *La Géographie*, XI, 1905, pp. 359–367, "La Distribution de la population en Suède en fonction de la constitution géologique du sol." See also the studies of human geography undertaken in Servia under the direction of the geologist and geographer, Cvijic, and reviewed by Jovan Erdeljanovic in the *Ann. de géog.*, XIV, 1905, pp. 424–432, under the title, "Les Études de géographie humaine en pays serbe."

Outside of large-scale topographical maps some very happy attempts have been made, first to substitute natural areas for conventional administrative areas and then to show the facts of population by suitable colors and signs. Earlier representations paid too little attention to the geographical reality. In general, progress is shown by a tendency to abandon the purely statistical representation and by a more or less successful effort toward showing definitely, with the aid of lines and colors, the actual geographical reality.

It is none the less true that the principle formulated by Ratzel is entirely sound. While the population of slight density is by nature unequally distributed, a very dense population tends to represent more and more the *statistical condition* and loses more and more its *specifically geographical characteristics.*[1]

3. The Limits of Human Establishments

It is important in every geographical question to consider and fix limits: the snow line, limits of zones of vegetation, etc. This is equally true for the facts of human distribution, which must be limited as to latitude and altitude.

The highest Alpine villages in Switzerland are:

	Altitude in Feet	Number of Inhabitants
Cresta	6,417	33
Juf, near Cresta	6,998	24
Findelen (Valais), summer village	6,890	
Chandolin	6,352	123
Lü (Münsterthal) (Grisons)	6,293	59
Arosa[2]	6,207	1,071
Saint-Moritz[3]	6,024	1,368

Pierre Hanssen, in his study of the house in the upper valley of the Sarine, has shown that the groups of permanent habitations, which are not found at altitudes higher than 2,600 feet (800 meters) in Gruyère, reach 3,300 feet (1,000 meters) at Gessenay, 4,900 (1,500 meters) at Gsteig, and even 5,400 (1,650

[1] *Anthropogeographie*, II, p. 240.

[2] Arosa owes its large number of inhabitants only to the fact that this village has become an important resort. In 1888 Arosa had only 88 inhabitants.

[3] All these villages, with the exception of Findelen, are *Kirchdörfer* or *Winterdörfer*, in contrast to the *écarts*—simple groups of permanent habitations. The importance of these figures is rendered more significant by the fact that, in the Carpathians of Wallachia, the average limit of habitations, permanent and isolated, is only between 3,300 and 6,600 feet (1,000 and 2,000 meters).

O. Marinelli

FIG. 75. A VILLAGE-TYPE OF THE COMELICO: COSTALTA IN THE ITALIAN ALPS

The picture does not include the entire village; a part of the agglomeration to the left is omitted. This village, which has preserved very well the traditional character of the region, has not so many inhabitants (860) as it appears. This is because the *stavoli* are mingled with the dwelling houses. Note to what degree the cultivated areas also seem to blend, so to speak, with the houses. The church is modern.

meters) in the high valleys of the affluents of the upper Sarine.

Along with *permanent* habitations we can and must consider those more or less comfortable structures used only during some weeks of the year, that is during the period of summer pasturage.

Otto Flückiger has investigated the upper limit of temporary habitations in Switzerland[1] and finds it to be 8,152 feet (2,485 meters) in the Val d'Anniviers.

It is to Olinto Marinelli that we owe the most suggestive observations as to the limits of the different types of temporary habitation (eastern Alps and particularly Venetia). His results are so important that they are presented here somewhat fully.[2] He shows us that, if the house is the primary object of observation, if it is sometimes the simplest and most barren of the facts of human geography, yet in studying it we are inevitably led to approach other series of connected facts, and not only facts of circulation, but facts of cultivation or of pastoral life.

Nomadism has been much more often studied in the steppes and plateaus of Asia than in the Alps. And yet it is here just as interesting if not more so. This Alpine nomadism is intimately bound up with property (communal or private), with the proximity of permanent habitation, and with pasture lands, the area of which is infinitely more restricted than those of the great steppes. The tents of the Asiatic nomads are therefore replaced by constructions which, though stable, yet always retain the character of *temporary habitations*. Under this name Marinelli includes not only those structures inhabited for a longer or shorter part of the year, but also those that serve as a refuge for the cattle and a temporary storehouse for hay, and whose location depends upon the distance from the village—that is, upon the altitude.

Starting with the permanently inhabited village (Fig. 75, p. 156) there is a gradual succession on the mountain sides

[1] *Die obere Grenze der menschlichen Siedelungen in der Schweiz, abgeleitet auf Grund der Verbreitung der Alphütten*, Stämpfli, Bern, 1906.

[2] O. Marinelli, "Per lo studio delle abitazione temporanee nelle nostre Alpi," *In Alto*, Cronaca della Soc. Alpina Friulana, A. XI, Udine, 1900; "Studi orografici nelle Alpi orientali," *Boll. della Soc. Geog. Italiana*, VIII, IX, and X, Rome, 1902. See also "Salita al Monte Cavallo," *In Alto*, XIII, 1902; *Studi sopra i limiti altimetrici*, I, *I limiti altimetrici in Comelico, Mem. geografiche*, etc., G. Dainelli, Florence, 1907.

in the Alpine valleys of eastern Venetia (Carnic and Cadoric Alps) of the following types of temporary habitations:

A. The *stavoli* (from Latin *stabulum*), are very common in the Carnic Alps, rarer in Cadore. They are constructions utilized generally twice a year, in spring and in autumn, as a stopping-place for the cattle for a longer or shorter period, when they go up to and when they come down from the Alpine pasture.

In general the *stavolo* is composed of three parts, which correspond to the dwelling-house, the stable, and the hay barn. It is a single building, sometimes entirely of wood, but more often with a base of masonry and almost always roofed with shingles.

B. The *fenili*, very common in Cadore but much rarer in the Carnic Alps, are designed for storing hay temporarily and are inhabited only during the haymaking season. In general the *fenil* is built entirely of wood and roofed with shingles and the bark of trees; sometimes it is raised above the ground and rests upon wooden supports or a base of hard stone; it has no windows, but the peculiar construction of the walls allows the air to circulate freely. In fact, the walls are generally made of trunks of trees roughly squared and roughly joined (Fig. 22, p. 85).

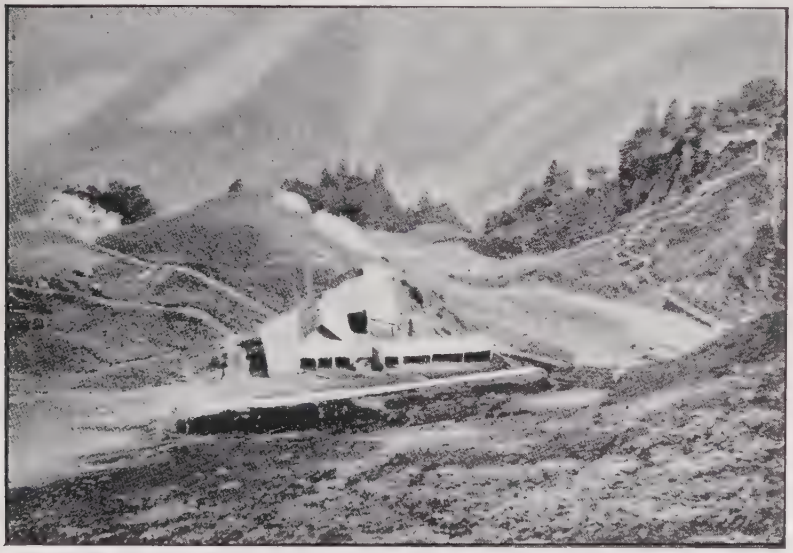
C. The *casere* are designed for the preparation of milk products and as a dwelling for the shepherds, or more exactly, the *armaillis*, during the summer use of the high pasture lands. Generally they are communal property. Each family of the commune sends thither its cattle, the milk is handled in common, and the products are divided among the owners of the cattle in proportion to the number of cows and to their yield of milk. The *casere* might be considered as coöperative Alpine dairies.

The *casera* is a group of buildings in the center of the pasture; it is composed of the *casera* proper and the *logge* or *tettoie* (Figs. 76, 77).

a) The *casera* proper is usually in large part of masonry; those entirely of wood are rare; the roof is generally made of shingles. Originally the *casera* seems to have consisted of a single room which served for all purposes, but this primitive simplicity has been maintained only in very rare cases.

To-day the *casera* is almost always composed of three rooms (or even four if it has two stories).

b) The *logge* or *tettoie* (sheds) are stables for sheltering the cattle during the night. Very long and closed only on one side,



O. Marinelli

FIG. 76. A TYPE OF CASERA IN THE ITALIAN ALPS

they are in general of wood, rarely of masonry or dry stone; the roof is always covered with shingles and has only a single slope.

When there are also sheep or goats, *logge* are not built for these animals, but a simple inclosure is constructed (a palisade or a wall of stone without mortar).

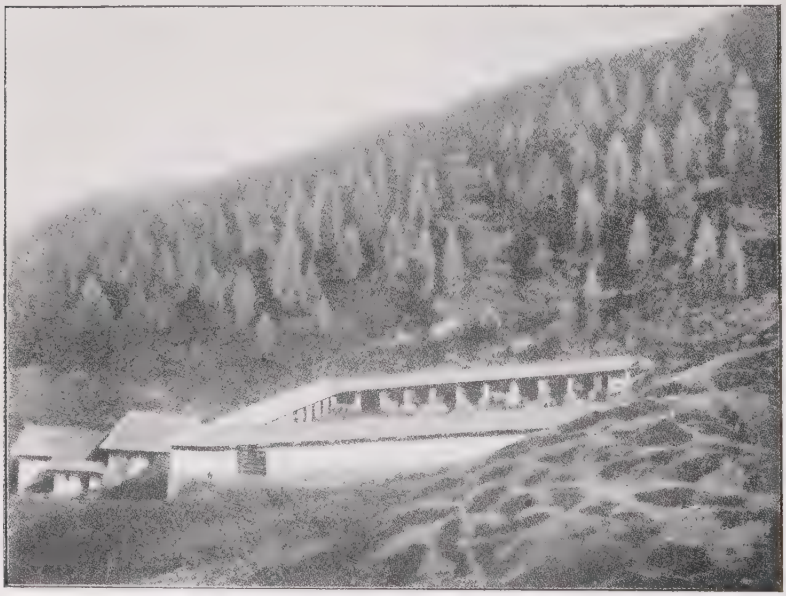
D. The *ricoveri* belong in general to the region which is still higher than that of the *casere;* they are not used exclusively by the shepherds, but in nearly every case also by wood-cutters, hunters, and others. They fall into two categories:

a) The *baite* are small temporary buildings constructed for some definite work (haymaking, making of charcoal, etc.). They serve as a shelter for storing the wood used for burning, or for storing charcoal or hay; often too, but for some few nights at the most, shepherds and hunters find a refuge there. The form of the *baite* varies, since in

their construction an attempt is made to utilize as far as possible natural conditions (a wall of rock or a cave-like hollow). The roof has in some cases two slopes and in others but one; it is covered with the bark of trees, with branches of fir, or with shingles.

b) The *casoni*, while serving almost the same purposes as the *baite*, are more stable. Generally they are shaped like *fenili*, but they are of larger dimensions and the walls are solid, with no cracks left for ventilation.

The *casere* are generally isolated. There are, however, some exceptions, notably in the mountains of Belluno where



O. Marinelli

FIG. 77. A TYPE OF CASERA IN THE COMELICO

In the illustration (Rinfreddo, in the Comelico, at an altitude of 6168 feet, 1880 m.), we see (1) on the left the casera proper (the part with the extension is the kitchen, while the more elevated portion consists of two stories, the store-room for cheese below [*cellei*], the herdsmen's dormitory above); and (2) in the middle of the illustration, the sheds for the animals (*logge*).

three or four *casere* are grouped on a single pasture ground; this is due to the fact that the pasture ground is parceled out to several families. A similar fact may be observed in the valley of the Resia and among the Slavs of the valleys of

the Torre and of the Natisone, where the communal pasture lands are ordinarily rented to a certain number of families each of which has its own *casera* and handles its own milk instead of handling it in common. All these *casere*, each standing apart from the other, form an ensemble which gives the impression of a primitive village; and in the case of these valleys it is permissible to speak of *summer villages* in contrast with *winter villages* (permanent habitations).

Analogous facts may also be observed in the valley of the Gail and even in certain regions of Corsica.

By means of diagrams and detailed statistical tables, Marinelli shows in a clear and ingenious manner the distribution and altitude of the types of habitation which characterize the three zones of pasturage, namely: the *houses* of the villages, which constitute the winter dwellings; the *stavoli*, spring and autumn dwellings; and the *casere*, summer dwellings; and he groups the eight regions of the territory which he has studied in three categories: inner regions, middle regions, and outer or pre-Alpine regions (Figs. 78, 79, 80).

He thus reaches the following conclusions which follow naturally from these tables:

1. The zones become lower as they proceed from the inner regions toward the outer.

2. In the pre-Alpine region the zone of the *stavoli* is much restricted and that of the *casere* is at a very low altitude.

3. The zone of the *casere* is cut in two by a wooded zone; the upper zone consists of the primitive pasture grounds, while the pasture grounds of the lower zone are the result of deforestation.

4. The zone of the *baite*, which characterizes the meager pasture grounds above the zone of the *casere*, rarely reaches, in the pre-Alpine region, 6,560 feet (2,000 meters), while in the Alps it sometimes exceeds 7,874 feet (2,400 meters).

For the Comelico, which belongs to the inmost and most northern part of the high mountain region examined, Marinelli notes the following facts:

The density is fairly great; it is 164 inhabitants per square mile (63 per square kilometer); in all, in 1901, 9,300 inhabitants were living upon 56.7 square miles (147 square kilometers). But the zones of altitude are even there much lower than in

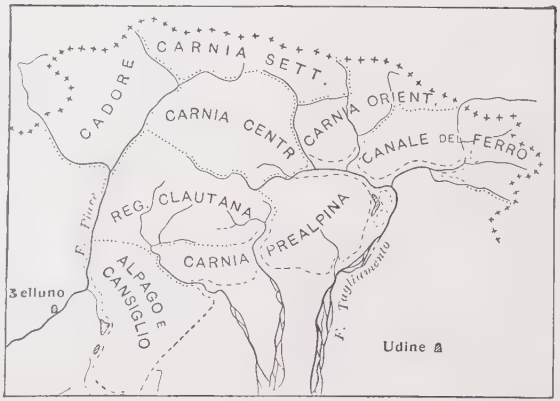


FIG. 78. DIAGRAM OF THE DISTRIBUTION OF NATURAL REGIONS IN THAT PART OF THE EASTERN ALPS STUDIED BY O. MARINELLI

At the exact point where meet the boundaries of the three regions, Cadore, northern Carnic Alps (Carnia Sett.), and central Carnic Alps (Carnia Centr.), is the little city of San Stefano di Cadore; the Comelico extends northwest from this point along the line separating the northern Carnic Alps from the Cadore.

Olinto Marinelli's ingenious efforts to represent diagrammatically the result of his investigations in altimetric limits merit the reproduction here of his diagrams. (Figs. 78 and 79.)

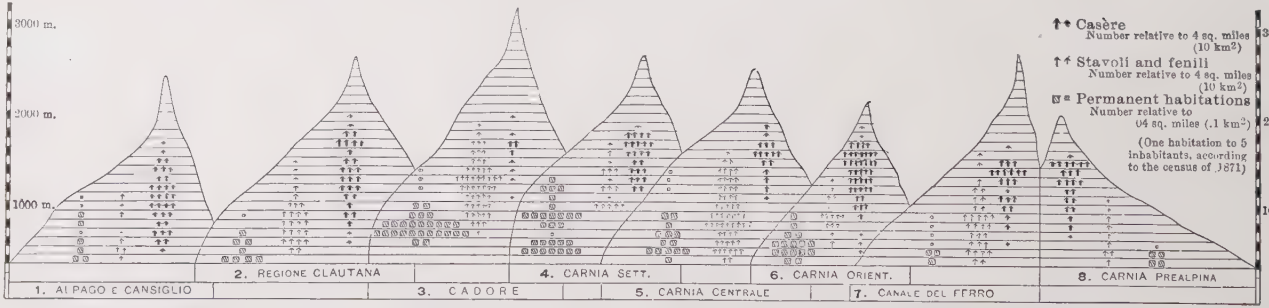

3000 m.
2000 m.
1000 m.
Casère
Number relative to 4 sq. miles (10 km²)
Stavoli and fenili
Number relative to 4 sq. miles (10 km²)
Permanent habitations
Number relative to 04 sq. miles (.1 km²)
(One habitation to 5 inhabitants, according to the census of 1871)
1. ALPAGO E CANSIGLIO
2. REGIONE CLAUTANA
3. CADORE
4. CARNIA SETT.
5. CARNIA CENTRALE
6. CARNIA ORIENT.
7. CANALE DEL FERRO
8. CARNIA PREALPINA

FIG. 79. SCHEME OF DISTRIBUTION OF THE VARIOUS TYPES OF PERMANENT OR TEMPORARY HABITATION IN A GROUP OF NATURAL REGIONS IN THE ORIENTAL ALPS AS DIAGRAMMED BY O. MARINELLI

The number of symbols for *casere*, *stavoli*, and *fenili* shows the number of these constructions in each 4 square miles (10 sq. kms.) of territory. The symbols for permanent habitations show the number to each .04 square mile (.1 sq. km.), with five inhabitants to each habitation according to the census of 1871.

other regions of the Alps. The houses of the highest village reach exactly 4,583 feet and a fraction (1,397 meters).

Here are the exact altitudes of all the highest *stavoli* of the Comelico, grouped according to their exposure:

Stavolo above Costalta..... 5,269 feet — exposure to southeast
Stavolo above Masdavoi..... 4,924 feet — exposure to southeast
Stavolo above Lake Campo..... 4,672 feet — exposure to southeast
Stavolo above Dosoledo..... 4,836 feet — exposure to southwest
Stavolo above Costalissoio ..... 4,350 feet — exposure to southwest
Stavolo above Casamazzagno... 5,259 feet — exposure to south
Stavolo above Costa..... 5,177 feet — exposure to south
Stavolo above Vantadei (Danta) 4,721 feet — exposure to south

The limit of the *casere* of the Comelico varies from 5000 to 6000 feet:

Casera Coltrondo..... 6,168 feet — exposure to south
Casera Silvella..... 5,994 feet — exposure to south
Casera Pian Minoldo..... 5,981 feet — exposure to south
Casera Melino..... 5,600 feet — exposure to south
Casera Ajarnola..... 5,282 feet — exposure to east
Casera Selvapiana..... 5,105 feet — exposure to south

Marinelli has studied more especially 107 *fenili* of this region and he thus sums up their altimetrical distribution:

8 *fenili* are found between 3,935 and 4,265 feet (1,200 and 1,300 meters)
6 *fenili* are found between 4,265 and 4,595 feet (1,300 and 1,400 meters)
25 *fenili* are found between 4,595 and 4,920 feet (1,400 and 1,500 meters)
23 *fenili* are found between 4,920 and 5,260 feet (1,500 and 1,600 meters)
21 *fenili* are found between 5,260 and 5,578 feet (1,600 and 1,700 meters)
17 *fenili* are found between 5,578 and 5,905 feet (1,700 and 1,800 meters)
7 *fenili* are found between 5,905 and 6,235 feet (1,800 and 1,900 meters)

As for the *baite*, two only have been observed—at 6,300 feet (1,920 meters) and at 6,783 feet (2,070 meters).

Marinelli then establishes other relations between the habitations and some other facts for the entire section of the eastern Alps under consideration:

1. The zone of permanent habitation corresponds to that of certain fixed crops of which the type is maize.

2. The zone of the *stavoli* is devoted to a variety of crops, a zone which ends with the cultivation of the potato.

3. The principal zone of the *casere* corresponds almost everywhere to the zone where full-grown forest trees predominate.

4. The upper zone of the *casere* coincides with the zone of shrubs and small trees which is also the zone of glacial cirques and morainic lakes.

From the point of view of means of communication, the lower zone is characterized by roads, the middle zone by mule paths, that of the *cascre* by the numerous paths followed by the cattle, and the highest by still more indefinite footpaths.

However, the correspondence between the zones and the phenomena cited does not imply so close a

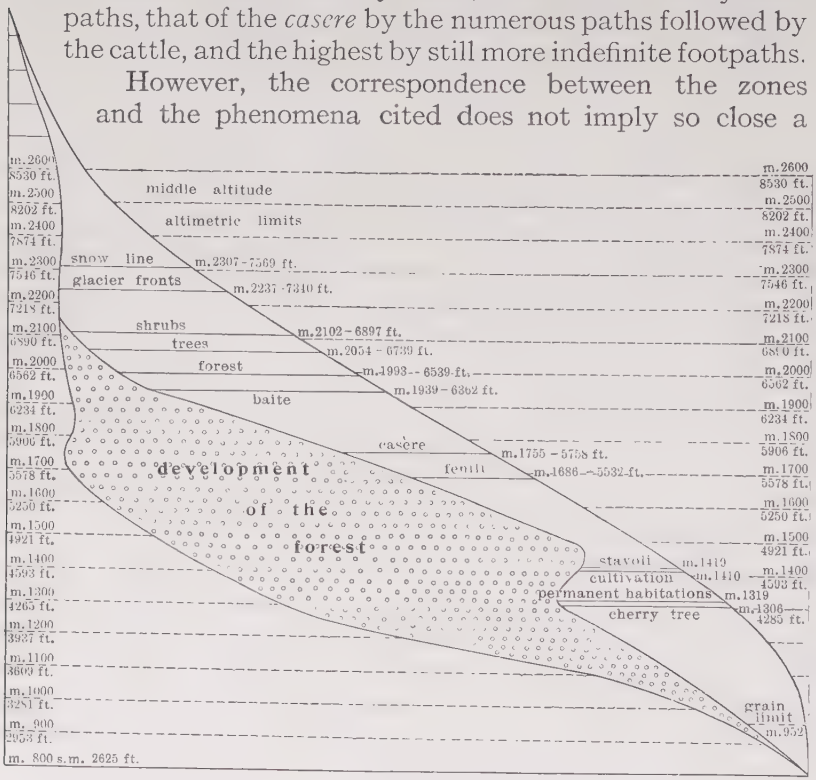


FIG. 80. DIAGRAM OF THE ALTIMETRIC LIMITS OF THE FOREST AND OF HUMAN FACTS IN THE COMELICO (AFTER O. MARINELLI)

The space between the two outside curves is in proportion to the surface corresponding to each altimetric zone; it is divided into two parts, one covered with forest and the other bare.

bond as one might think. Thus, to cite but a single example, with the opening of a new road there is not always a corresponding modification of the zone of permanent habitations.

The presence of temporary habitations does not depend alone upon altitude, but also upon geographical factors. A rock which is a shelter from the wind, the neighborhood of a spring, etc., play a part in the distribution.

Besides the intelligent modification which man brings about in pasture land with a view to its exploitation, he further contributes to the diffusion of plants and the lower animals by transporting species from the zone of permanent habitation to the zone of the *casere*, or vice versa.

It is important to realize this bond which connects the house with all other modes of human activity. To begin with the house, then the road, then to proceed to the facts of plant and animal conquest or the facts of destructive exploitation, is to follow a convenient order of increasing complexity; but this method of observation, far from establishing false boundaries between these different orders of phenomena, by the analysis of the first and most simple, brings us in touch with all the other related phenomena.

The house in its very form undergoes the influence of man's work, and many exact observations may be made analogous to the following:

"While in certain large agricultural plains the granary seems to crush the house by occupying three quarters of its height, here [in the vine country] on the contrary the house seems uplifted by the cellar."[1]

The hop-house in Franconia has ground floors of the height of several stories for drying rooms.[2]

Other properly human elements act upon the location of human establishments, and one cannot emphasize too fully the part played by these human factors, historical, religious, etc.

An intense historical life maintains a city in an environment which is geographically abnormal. Jerusalem no longer has its vast aqueducts; the reservoir called "wells of Solomon" no longer flows — it possesses but two little insignificant springs, and the past of Jerusalem keeps there upon the harsh plateau of Judea 40,000 inhabitants who have at their disposal only the water of cisterns! Still further, a definite political interest may create an entirely artificial establishment. Aden is in a position which England jealously guards, in an environment so inhospitable that all fresh water must be brought by sea.

[1]From Demangeon, "Le Kaiserstuhl" (Brisgau), *Ann. de géog.*, March 15, 1902, p. 152.

[2]See Louis Arqué, "Les Cultivateurs de houblon en Franconie," *La Science sociale*, 23d year, December, 1908, pp. 217–328.

Finally there are cases where men, with deliberate purpose, create a settlement in a new country precisely in order that there may be no bonds with any earlier political interests. Although great care was taken to realize all the best physical conditions, relief, springs, vegetation, picturesqueness, ease of communication with a port,[1] etc., the Australian Confederation in choosing in June, 1909, as a place for the new federal capital, the site of Canberra on the Molonglo, created by decree the geographical fact as one might fix by decree or by treaty an administrative division.[2]

By the sudden and unexpected fact of the decision of the King of England, Emperor of India, proclaimed at the time of the Durbar celebration, December, 1911, the capital of English India is henceforth no longer Calcutta, and the old city of Delhi has recovered its political primacy.

Our interest is more strongly attracted by less conspicuous and more complex historical phenomena such as the following:

When conditions are unfavorable to an urban establishment it seems that a more ingenious necessity and a more considerable human force are alone capable of overcoming the difficulty. It is then no longer a village, but a city, which will be the exception; a slighter effort would not have succeeded.

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[1] See "The Capital of the Australian Commonwealth," *Geog. Jour.*, March, 1910, pp. 318–321, with three maps or charts; and J. Taylor, "The Evolution of a Capital: A Physiographic Study of the Foundation of Canberra, Australia," *Geog. Jour.*, 1914, pp. 536–554.

[2] To show to what an extent this establishment of the capital is an artificial and carefully planned fact, we reproduce here the advertisement which the leading papers of the various countries published in the second half of the year 1911:

CONTEST OF PLANS
FOR THE CAPITAL CITY
OF THE
AUSTRALIAN CONFEDERATION

The government of the Australian Confederation requests the submission of plans for the capital city of the Confederation, and the following prizes are offered:

For the plan given first place	£1750	$8,516.37
For the plan given second place	750	3,650.00
For the plan given third place	500	2,433.25

The conditions ruling the contest, as well as all information and details, plans and instructions, may be obtained from the British Ambassador at Paris.

The plans will be received at the Department of the Interior, Melbourne (Australia), up to January 31, 1912.

KING O'MALLEY
Minister of State for the Interior
Australian Confederation

May 24, 1911

Thus in the valley of Graisivaudan, obstructed and swept by the floods of the Isère, groups of human beings have lodged themselves upon the terraces and alluvial cones. One single human group escapes the rule and that is the chief one, Grenoble.[1] Likewise along the Sarine, shut in by a canyon with abrupt walls from the bridge of Thusy to Laupen, men have not established themselves. Here we find an old castle, or a watch tower, there an old monastery, here again houses grouped about a quarry; but in general the Sarine flows deserted. There is a single exception and that is the chief city, Fribourg (ancient

[1]Raoul Blanchard, in a lecture on Dauphiné given before the general assembly of the Touring Club of France, December 3, 1911, said: "The appearance of that great valley of the Isère, especially between the frontiers of Savoy and Grenoble, where the cliffs of Chartreuse and the needle-like peaks of Belledonne tower close above it, is one of the most characteristic features of Dauphiné. On each side, are steep walls which seem to defy ascent. At the bottom is an alluvial plain, from two to three miles wide, through the middle of which meanders the dyked Isère. On the banks are sloping heaps of débris fallen from the hillsides, or alluvial cones—flattened by accumulations of material brought down by tributary streams. The level rises but slightly, varying along the Isère from 600 feet (210 m.) down stream, to 800 feet (250 m.) farther up; and thanks to this very slight elevation, a very mild temperature can prevail, even in the heart of the mountain. The orientation, however, produces, on one side and the other, a great variety of aptitudes. The right bank, exposed to the southeast, that is, to the rays of a burning sun, forms, on the limestone flank of Chartreuse, which protects it from cold, damp winds, a gigantic trellis. This is the domain of fruit trees, of the vine, of the mulberry, the region of châteaux and of pleasure houses. Large villages, scattered on the slopes of talus, follow each other without a break, from Grenoble to the border of Savoy. The left bank, which looks to the north and east, is less happily placed for agriculture; the slopes are wooded, while cultivation is concentrated on the alluvial cones. But this bank is admirably adapted to industry. There issue great torrents, descending from the snowy heights of Belledonne, which by their volume and the steepness of their fall lend themselves remarkably to the establishment of hydraulic factories. The "white coal," or the utilization of the motive force of Alpine streams, had its birth on this side of Grésivaudan, and great paper and metal factories are installed at the mouths of the chief affluents—at Pontcharra, Froges, Brignoud, Lancey, and Domène. The villages established within their range, on the alluvial cones, are increased by a considerable population of factory workers and tend to become cities. Finally, between the two flanks, the low plain, still damp in spite of the drainage canals, lends itself admirably to the cultivation of thirsty plants, formerly hemp, now tobacco. Thus this subalpine depression presents a remarkable variety in its adaptability to agriculture and to industry. It has also a commercial rôle, which is no less important. From that long cleft emerge all the great Alpine routes, those which come down from the interior of the chain, through upper Isère, Arc, Romanche, and upper Durance; those which lead out of the mountains through the passes of Chambéry and Annecy, low Isère, and lower Durance. All these routes cross and connect with each other in this depression. Here is the heart of the Alps. Through this valley the railroads have made their way; here have grown up commercial cities—stopping places, and markets through which the products of the mountain are exchanged for those from outside regions: Gap and La Mure to the south, and Chambéry and Albertville to the north. But Grenoble is the most important of all. Situated at the junction of the Drac and the Isère, commanding the routes from the Alps toward Lyons, it is the true capital of the French Alps, and especially of the Alps of Dauphiné—an industrial capital which utilizes the products of the mountain in its glove factories and cement works and furnishes the hydraulic factories with turbines and pipes; a military capital which guards the passes; an intellectual metropolis; finally, the point of departure for tourists, who start from there for the conquest of great summits whose proud line unrolls its snowy peaks above the valley." See also, by the same author, *Grenoble, Étude de géographie urbaine*, Colin, Paris, 1911, p. 162.

ford, then bridge, then *burg* built up at the point of passage).[1]

We hasten to add that many complex facts of the human order have coöperated in these obscure, almost unconscious choices of certain points as sites for cities. Ease of exchange on the borderland of very unlike natural regions has, as it were, given birth to lines of cities. Many examples might be cited (see Fig. 1.) In the Vosges, it is on the borderland between the plain and the mountain that have been established the markets, Raon-l'Étape, Senones, Gerardmer, Saulxures, Bussang, etc., where from an early date cattle and products of mountain industry have been exchanged for the grain and the wool of the lowlands, and at a new turn of economic evolution these markets very naturally have become active little industrial centers.

In the United States, Denver and Pueblo, Colorado, have grown up on the edge of plains near accessible pathways to the high mountains, and have become not only distributing centers for goods from or to the mountains, but industrial centers dependent in part on raw materials from the mountains.

Along with the other conditions of situation and the question of defense, etc., the economic activity of men and the principal economic activity of each group play their part. For example, men who spin, weave, and dye will establish themselves near pure running water, as at Lyons, France, or Paterson, New Jersey. A. Hettner even remarks justly that it is these geographical factors, connected with a certain mode of economic activity, that are called upon to play the leading part in

[1]Paul Girardin has devoted to Fribourg a very remarkable study of human geography, the conclusion of which is as follows: "Three times in succession in the course of the nineteenth century, Fribourg has almost been prevented from growing, or has just escaped leaving parts of the city behind the others in development: the first time was when it was a question of bridging the Sarine; the second time it was the cutting of the ravines; and the third time it was the difference in level between different parts of the city—a fact which in the Middle Ages did not press so heavily on the city organism. Each time it was necessary to find some technical improvement to surmount the obstacle, and in particular to have the courage to apply it. Each of these obstacles was caused by nature; each of these problems was set by geography. Human initiative solved or eluded them, one by one. There was here, however, a strange turn of affairs, which brought it to pass that the *influencing* conditions—which in the beginning determined the choice of the city's situation—have changed their rôle in the course of time, and have become *restrictive*, hindering either the growth of the city or the uniting of its different quarters. It is man, in this struggle with nature, who has had the last word. From the greatest of the Zachringens to his successors, it has been human wills that have created Fribourg, that have developed it, and now maintain it." ("Fribourg et son site géographique, Étude de géographie urbaine," *Bul. Soc. neuchâteloise de géog.*, XX, 1909–1910, pp. 117–128 and 2 plates.)

the further development of the center of human establishment.[1]

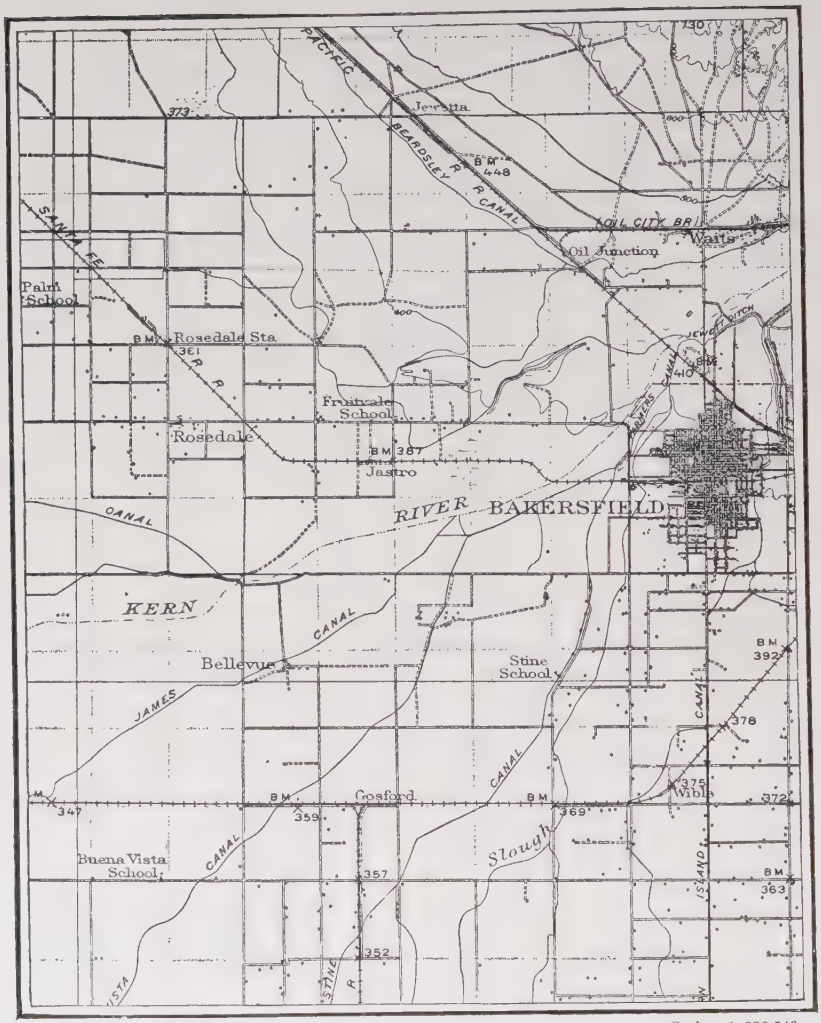
It is proper to add that there is not a city or a road which bears within itself alone all the reasons of its development. From the moment of its existence, it shares in relations which taken together hold the secret of its future. The more the phenomenon grows, the more it is dependent upon its environment, and this environment, of which the chief factor is the ease and rapidity of communication, is always more or less shaped or modified by human will.

5. THE URBAN AGGLOMERATION AND THE "CITY" ROAD. THE GREAT CITY AND GREAT CITIES. BRIEF COMMENTS ON AN EXAMPLE OF COMPARATIVE GEOGRAPHY: THE GREAT CITIES OF THE WORLD ABOVE 4,900 FEET (1,500 METERS)

The concentration of habitations keeps pace with the concentration of paths of communication. The larger a city, the finer the network of roads which surround it. Inversely, the more physical conditions favor the concentration of roads at one point, the more possibilities of growth a city has. The essential needs of the inhabitants demand for their satisfaction a fine network of paths of communication. One must think, for example, of what is consumed every day by an urban center of two and a half million inhabitants like Paris and what must be brought every day to its city markets, in order to comprehend how much space is taken up in Parisian suburbs by railroads, highways, or streets.[2] This is even more notable in the case of La Paz, whose 60,000 inhabitants are supplied largely from a vast semi-arid plateau to the west and tropical valleys to the east. Hundreds of mule trains daily enter its squares, bringing barley and potatoes over scores of mountain trails.

[1] A. Hettner, "Die wirtschaftlichen Typen der Ansiedlungen," *Geog. Zeitschr.*, VIII, 1902, p. 98.

[2] Paris consumes annually, according to the calculations of D. Zolla, about 661,380,000 pounds (3,000,000 quintals) of wheat flour (D. Zolla, *Le Blé et les céréales*, p. 219). It consumes also 440,920,000 pounds (2,000,000 quintals) of meat, 100,970,680 pounds (458,000 quintals) of fish, etc. From the geographical point of view, one should above all investigate and *see* by what material means these various foodstuffs actually reach the city: 26,417,500 gallons (100,000,000 litres) of milk through the system of lines from the west; 17,636,800 pounds (80,000 quintals) of fruit and vegetables by the railroad running from Paris to Arpajon; of the 1,789,000 sheep brought to Paris in 1906, a million and a third of them came in on foot through the gate of the rue d'Allemagne, etc. These figures are those of 1906, according to Edouard Payen, "Comment s'alimente une grande ville," *Rev. écon. internat.*, February 15–20, 1908, pp. 370–391. Great loads of coal come to Paris by the system of lines to the north and especially by the canals of the north and the navigable Oise, etc.



Scale = 1:336,540

FIG. 81. THE RADIAL SYSTEM OF ROADS ABOUT A CENTER

From Buena Vista Lake Quadrangle — Calif. U. S. G. S.

Great empires have always expressed themselves by roads: the Roman Empire and the old empire of the Incas, as well as the recent empire of Napoleon. Economic or political capitals form the center of a "star" of roads; the phenomenon may be verified on a large or small scale (see Fig. 81).

In attaching roads to itself the city commands and maintains them. While a simple trail like that followed by the small caravan across the plains of Galilee in Figure 82 may be very

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FIG. 82. A SHIFTING TRAIL ACROSS THE PLAINS OF GALILEE

easily displaced, every great city, by becoming an almost necessary point of arrival and departure, fixes roads at least for a long time and gives a certain permanence to the main directions successively adopted by more and more modern types of paths of circulation.

A pass in the high mountains is naturally suggested as a road by the general conditions of the relief. But if this pass does become a road, it needs, in order to remain so, urban centers which safeguard it and which, by exercising their influence from afar, keep the road passing at this naturally favorable point (Fig. 84).

The road leads toward the urban center and depends upon it; but this constructed center also depends upon the road. The city creates the road; the road in its turn creates the city or re-creates it — that is, displaces it or changes its form. Sometimes the agglomeration slowly extends downward little

Jean Mournès

FIG. 83. THE ANCIENT LITTLE CITY OF CORDES (FRANCE), TYPE OF THE CITY PERCHED ON A HEIGHT AND ILLUSTRATING HOW THE CITY SLOWLY COMES DOWN THE SLOPE BY ERECTING NEW HOUSES ALONG THE ROADS

Schools, factories, etc. are being built lower and lower down the hillside

by little (see Fig. 83). Sometimes the phenomenon is more complex and more radical in its consequences. Bergamo was built as a fortress upon one of those eminences which form the outposts of the Alps toward the Lombard Plain. Little by little the city has, so to speak, come down the slopes, and suburbs have grown up right and left at the foot of the fortified

From *Asie et Insulinde*, Busson, Fèvre et Hauser, Paris

FIG. 84. A CARAVAN FROM KABUL CROSSING KHYBER PASS

Peshawar and Kabul sustain the importance and value as a road of Khyber Pass, in the Sulaiman mountains, between the plain of the Indus and Iran.

hill. Finally the railroad and the station were located between the suburbs in the plain in front of old Bergamo. The road thus unites and concentrates around the station the new city which, with its great central avenue and by the aspect of its buildings, is going to give birth to a new Bergamo at the foot of the old. The city of Quebec has already passed through this cycle and the new city at the base of the fortified heights transcends the old (Fig. 85).

How many cities and villages have been controlled in their plan by the road and by the waterway as well as by the land road! (Figs. 86, 87.) The Rhine and its tributaries, the Moselle and the Lahn, cross the Rhenish plateau and flow generally at the foot of steep slopes which extend from the present river beds to the upper level of the old peneplain. This arrangement of surface features, by consigning the

Wm. Notman & Son, Montreal

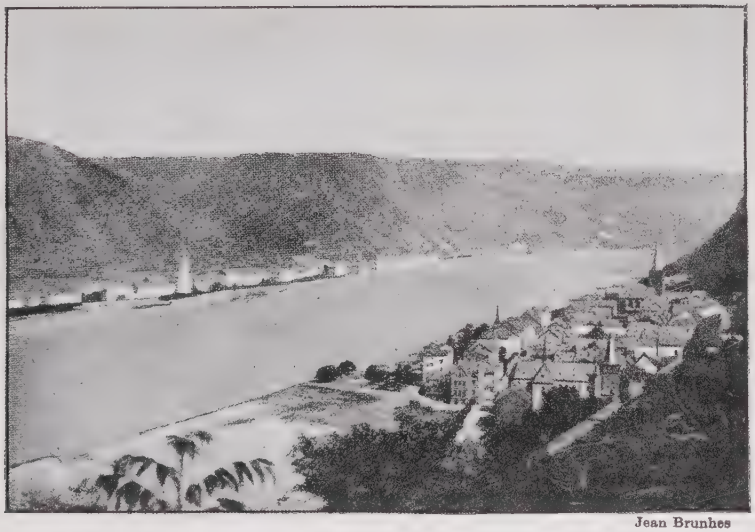
FIG. 85. THE NEW TOWN OF QUEBEC, LYING ALONG THE WATER FRONT AT THE BASE OF THE PRECIPITOUS FORTIFIED BLUFF, IS THE SEAT OF COMMERCE

Jean Brunhes

FIG. 86. BRAUNLAGE (HARZ). NOTE HOW VISIBLY THE HUMAN SETTLEMENT IS CUTTING INTO THE FOREST

houses to the base of the slopes and to the line of contact with the water courses, has multiplied such typical cases upon the two banks (Fig. 88).

The village, representing a smaller effort at human establishment, is still more sensitive to the influence of the road than is the small city; in many villages and hamlets the houses



Jean Brunhes

FIG. 87. ST. GOAR AND ST. GOARSHAUSEN, ON THE BANKS OF THE RHINE

The houses are aligned along the river-road, the villages or cities succeeding each other along the banks.

are placed side by side along the route of travel. To this characteristic arrangement the Germans give the name of *Strassendorf* or even of *Gassendorf:* road-village or street-village.

There are many examples of inhabited centers created by the road.[1] As a consequence of the construction of the St. Gotthard in Tessin, a village, Lavorgo, grew up between Faido and Giornico, while Dazio began to fall into decadence and farther on the little port of Magadino, at the head of Lago

[1]This fact of human geography associated with human occupation may well be called the "political road," giving to this word its etymological meaning from the Greek word πολι. If we find constant relations connecting the house and the road, it must be admitted that it is the urban center which is the concentrated and pre-eminent expression of this connection.

Maggiore, played henceforth only an insignificant part. At the Red Sea mouth of the Suez Canal, Port Tewfik has been built, while the older Suez has become a slowly dying city, abandoned, dirty, and nauseating. In Fort Francis, Ontario, the older town faces the Rainy River, the highway in the days of the fur trade and in the later lumbering development. The newer town has turned its back on the river and is attached to the railroad which was built on the outskirts of the original town.

In old cities it often happened that bridge and house were so closely associated that the bridge was itself covered with buildings. This was the case in old Paris (bridge of St. Michel) and may still be seen at Florence and at Kreuznach[1] (Fig. 89).

H. Busson

FIG. 88. THE CITY OF EMS

The houses are lined along the two banks of the Lahn, between the river and the foot of the wooded slopes.

The large city deserves to be studied in itself and for itself as an exceptionally important fact of human establishment. Meuriot has made a comparative statistical study of the great urban agglomerations of Europe.[2] Under the direction of the economist, Bücher, and with the collaboration of such men as Ratzel, a group of

[1] See also what has been said above of Medinet and the Fayum, p. 129.

[2] P. Meuriot, *Des Agglomérations urbaines dans l'Europe contemporaine*, Belin, Paris, 1897. See also Adna Ferrin Weber, *The Growth of Cities in the Nineteenth Century, a Study in Statistics*, New York and London, 1899; and the chapter by Georg von Mayr, "Die Bevolkerung der Grossstadte," in the volume *Die Grossstadt*, cited below; also F. P. Gulliver, "Vienna as a Type City," *Jour. School Geog.*, IV, 1900, pp. 175–179.

suggestive studies has been published entitled: *Die Grossstadt.*[1]

These studies are not all equally geographical. The city,

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FIG. 89. THE OLD BUILT-UP BRIDGE OF KREUZNACH

This part of the road, the bridge, literally carries the houses

like the village, the hamlet, or the house, must be treated as a sort of natural being to which may be applied the methods of comparison of the observational sciences. This comparison must be applied to the whole as well as to the essential elements which compose the large agglomeration.

O. Schlüter has made an effort to renew the tradition of J. G. Kohl;[2] he has even commented with keen interest

[1] *Die Grossstadt, Vorträge und Aufsätze zur Städteausstellung*, by K. Bücher, Friedrich Ratzel, Georg von Mayr, H. Waenting, Simmel, Th. Petermann, and D. Schaefer, Gehe-Stiftung zu Dresden, Winter, 1902–1903, von Zahn und Jaensch, Dresden, 1903.

Very detailed monographs have been written upon cities of the first rank such as Paris and London, and their progressive development has been analyzed with a remarkable attention to geographical conditions. The *Geographical Dictionary of Switzerland*, owing chiefly to the activity of the geographer, Knapp, contains a large number of plans drawn by Borel which show in different colors the successive zones of development of the largest cities. Finally, very many eminent observers and writers have tried to describe the physiognomy and the most expressive characteristics of all the significant cities.

[2] "Bemerkungen zur Siedelungsgeographie," *Geog. Zeitschr.*, V., 1899, pp. 65–84.

upon the studies of Stübben and of J. Fritz.[1] The principles of grouping and classification should be more boldly and further extended; in the second place, it is important that geographers should remain always geographers rather than statisticians or historians.

However, among the good works consecrated to the geography of cities let us cite further a little book by Kurt Hassert,[2] and the remarkably illustrated article by Eugen Oberhummer.[3]

The second is especially devoted to the study of city plans, and it is in this article that the author makes the suggestion — which he later caused to be adopted at the International Geographical Congress at Geneva[4] — that city plans should be given a real geographical value by having them show also relief by means of curved lines or cross-hatching.[5]

Ratzel had shown particularly the part played by the *situation*[6] in the history of a city's development. Oberhummer considered especially the *plan* of cities as projected on a plane surface.[7] Hassert described the city finally in its total

[1] "Über den Grundriss der Städte," *Zeitschr. der Ges. für Erdkunde zu Berlin*, XXXIV, 1899, pp. 446–462 and 10 plans.

[2] Kurt Hassert, *Die Städte, geographisch betrachtet*, Teubner, Leipzig, 1907.

[3] E. Oberhummer, "Der Stadtplan, seine Entwickelung und seine geographische Bedeutung," *Verh. des XVI. deutschen Geographentages zu Nürnberg, 1907*, D. Reimer (E. Vohsen), Berlin, 1907, pp. 66–101 and 21 figures.

[4] E. Oberhummer, "Die Geographie der grossen Städte," *Compte rendu du neuvième Congrès international de géographie, Genève, 1908*, published at Geneva, 1909, pp. 464–466.

[5] See a very good article by G. A. Hüeckel, "Les Plans de villes instruments de travail," *Rev. scientifique*, May, 1909, pp. 683–689. See also Camillo Sitte, *L'Art de bâtir les villes; Notes et reflexions d'un architecte*, translated and completed by Camille Martin, Eggimann, Geneva, and Renouard, Paris; many small plans reduced.

[6] In a more detailed study it would be necessary to distinguish between and to consider in turn the situation or general *geographical* position, and the situation or local *topographical* position; the first might be (or become) excellent and the other bad, or inversely. For the influence of situation on the destiny of a city, see A. Vacher, "Montluçon: Essai de géographie urbaine," *Ann. de géog.*, XIII, 1904, pp. 334–347, and the monographs cited on pp. 178 and 179.

[7] The comparison of the plans of cities, especially if one could put them in the same scale, would suggest a very great number of historical, economical, or social observations. The great city of ancient times included gardens, cultivated tracts, and scattered houses. Thus it is that, according to information given by Herodotus (I, 178), translated by Karl Bücher, we can understand that ancient Babylon, with a much smaller population, covered a surface equivalent to that of Berlin to-day. (Ratzel, "Die geographische Lage der grossen Städte," in *Die Grossstadt*, p. 37). See especially the remarkable article on urban geography by Mark Jefferson, "The Anthropography of Some Great Cities. A Study in Distribution of Population," *Bull. Amer. Geog. Soc.*, Vol. XLI, September, 1909, pp. 537–566. See also Arthur Schneider, "Stadtumfange in Altertum und Gegenwart," *Geog. Zeitschr.*, I, 1895, pp. 676–678.

physiognomy, which comes in large part from the style of its houses, from the silhouette of its monuments on the horizon, in short, from the *height* of its constructed parts. These then are the three essential factors which coöperate in making the city a geographical phenomenon. These are evidently not the only factors, but they are the chief ones.

It is first of all a duty of geography, as Hettner well says, to describe human establishments in their economic rôle, in their dimensions, their form, their geographical situation, their plan of construction, in the materials of which they are built (let us add, especially, the form and character of their roofs with their gutters, chimneys, etc.), and in their other peculiarities; and it is chiefly a duty of general or comparative geography to compare the establishments of different countries from these points of view and to seek the causes of their diversity (or of their resemblance).[1]

Merely by their position, cities may belong to the same type. For instance, at the extremity of the lakes of Zürich, of Lucerne, of Thun, and of Geneva, and astride the water course which is the outlet of each of these lakes, are Zürich, Lucerne, Thun, and Geneva.

He who looks at three cities of the Mediterranean coast, such as Ventimiglia, Menton, and Antibes, cannot fail to be struck by their "relationship." But these analogies are found even between cities which are far distant from each other. Luxemburg, which rises above the intrenched valley of the Alzette, resembles Fribourg (Switzerland), proudly perched upon a promontory of the canyon of the Sarine, almost as much as Fribourg resembles Bern (which had the same founder) and more than it resembles other Swiss cities of analogous situation, such as Aarburg or Burgdorf.

Cities which do not resemble each other in their exterior appearance can still express in an analogous manner certain necessities to which they are subjected.

When a settlement is restricted as the result of either natural or human causes, the house rises in height; the stories are piled upon each other. In a small oasis of the Ziban (South Algeria) surrounded on all sides by the precious palms which

[1] A Hettner, "Die Lage der menschlichen Ansiedelungen," *Geog. Zeitschr.*, I, 1895, p. 361. This interest in comparison has been met by expositions of city plans, such as that which was held at Zürich in the spring of 1911, or the magnificent exposition, La Transformation de Paris sous le second Empire, organized in 1910 by the Service historique de la ville de Paris.

Neurdein

FIG. 90. IN THE RESTRICTED CITY THE HOUSE RISES IN HEIGHT: PONT-EN-ROYANS

The Vercors is a large calcareous plateau, undulating and with steep ledges, with very narrow valleys. It is moderately populated; the little cities are naturally situated in the valleys; hemmed in between the river and the nearly vertical slope, the houses are necessarily several stories higher.

they are loath to sacrifice, the houses of dried earth boldly risk two and three stories (Lichana), just as in the Spanish city of Cadiz, shut in by the sea at the extremity of its peninsula, the houses rise very high. At Lyons, at Genoa, etc., we see the same effect. Again, a simple river, the Bourne, skirting the steep bluffs of Vercors, obliges the house of Pont-en-Royans to rise up straight above the water (Fig. 90). And colossal New York, where land is limited and costly, holds the record for steel "skyscrapers," buildings which reach nearly 700 feet (213 meters) in height. Even in sections of the city devoted to dwellings, apartment houses holding many families range from six to ten or twelve stories in height. So characteristic is this layered arrangement of homes in New York that, in order to attract the attention of possible buyers in the upper stories, display signs are placed on the tops as well as the sides of the delivery wagons of milk dealers, bakers, and other merchants.

There are cities which so resemble each other in their essential elements that they form a sort of family. Venice, Amsterdam, Danzig, etc., are cities built on or near the water. They have the common characteristic of being *canal cities;* and they certainly deserve to be grouped together and compared (Figs. 91, 92, 93). The great advantage of such a grouping based upon essential qualities is that we can compare these perfect and homogeneous types with small portions of other cities which have similar geographical features (Strassburg with its little corner *Klein Frankreich,* Hamburg, Bruges, Metz, etc., see Fig. 94).

Likewise, cities in different parts of the world have the common characteristic of being created in a factitious manner, so to speak, with a view to housing inhabitants who are only transient, cities which have at the same time needs that are very compelling even if intermittent; such are the hotel cities: Zermatt, Interlaken, Territet, Le Mont Dore, Atlantic City, Palm Beach, etc.

Cities built to meet the same political purpose and reflecting similar points of view and tastes are often strikingly alike even in details. A. Metin has well caught and expressed the similar aspect of English cities in India.[1]

[1] A. Metin, *L'Inde d'aujourd'hui,* pp. 178–180.

From the military *cantonment* to the "residence" of the capital of a native prince, from the smallest chief town of a district to Bombay and Calcutta, all the *English cities* are of the same type;

Jean Brunhes

FIG. 91. A CANAL CITY: THE *SITUATION* OF VENICE IN THE MIDDLE OF THE LAGOON

This perspective allows the whole of the situation (see p. 184) to be observed; we can distinguish the S of the *Canal Grande*, in the background the bridge of the railroad which unites the city built on piles with the mainland, and in the foreground the little islands of the *Giudecca* and of *San Giorgio Maggiore*. A child, noticing the outline of this illustration, said: "the fish city."

only the dimensions change. The Englishman never dwells in the *native city* — he even affects to despise it. The wives of officials who have been in the country for several years claim that they have never entered the Indian quarters, under the pretext that they have nothing interesting to offer or that they are too dirty. Tradition obliges the English staff, civil or military, to reside in villas surrounded by gardens and strung along the wide avenues bordered by trees which make of the English city an immense labyrinth without other landmarks than the church steeples. It seems that they have wished to realize the dream of William Morris, of dwellings lost in verdure and separated from each other by lawns and parks. The English quarter is almost always so far away from the native quarter that the one cannot be seen from the other. An immense space is required for the avenues and the gardens. Lahore and Madras have an area almost equal to that of Paris, and nine-tenths of it, like the fashionable sections of English cities, is occupied by the small British colony, while the enormous native population is

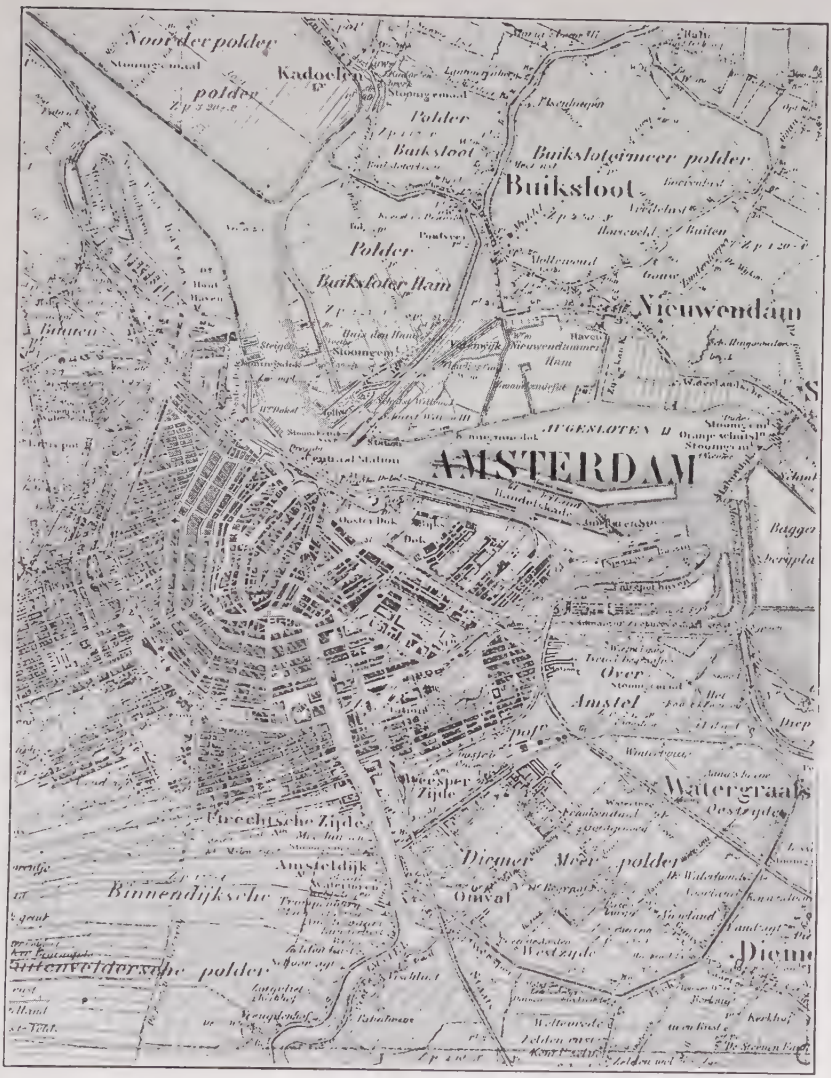

FIG. 92. A VERY LARGE CANAL CITY: THE *PLAN* OF *AMSTERDAM*

Arrangement of the built-up portions and of the ways of communication in this huge city conquered from the water in the midst of cultivated fields likewise gained by human effort (*polders*).

From sheet 23, Amsterdam, of the official Dutch map, 1:50,000

concentrated upon a space of some acres in the overcrowded houses and the narrow streets of the old city. The ports of Bombay and Calcutta have in their center a business quarter, a sort of "city" analogous to the city of London, which is the ancient company "fort." But here are found only offices occupied during the day; when evening comes all the English are to be found in their country houses.

The mountain stations where the high officials and people of leisure take refuge during the hot season, especially Simla, the summer residence of the Viceroy, attract a public similar to that of fashionable watering-places or seashore resorts. The women

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FIG. 93. THE GRAND CANAL, VENICE. *CIRCULATION* IN A CITY OF CANALS

The Grand Canal is one of the 150 canals or water streets of Venice. Means of circulation are the specially adapted boats (gondolas).

particularly resort to them, leaving their husbands to continue their civil or military duties in the burning plains.

There is another modern type of city, the great manufacturing town, and this type must be boldly charged to the

account of coal — not that it rises on the site of the coal field, but the logical place for its study is *after* the geographical facts which are the result of the exploitation of this mineral. This type of city will thus receive further consideration. (See chapter V, § 4.)

L. L.

FIG. 94. A CANAL OF THE OLD CITY OF BRUGES

The countries which have no coal and which nevertheless have become industrial are almost unacquainted with this type of agglomeration. In the northern part of Italy, for example, the factories are scattered everywhere, near little railroad stations, in the open country; they are close neighbors of the almond and mulberry trees; here and there they seem to be scattered over the wheat and maize fields. This distribution of industrial life is far removed from that concentration which has particularly marked the beginnings of the coal era, and which remains the genuine echo of it. It indicates on the contrary rather what industrial geography may more and more become as the *exclusive* reign of coal dies out.

These modern industrial cities have an ugliness that is often misinterpreted and charged to causes which are not responsible for it.

What more monotonous and vulgar than the huge factories of our large and populous cities! A given factory of Warsaw resembles the factories of Cologne as well as those of Roubaix and Birmingham. We hastily build vast barracks of some

cheap material like bricks, and we give little attention to the architecture.

That is why brick has had to serve in building modern industrial cities; but why blame it for the vulgarity of our own tastes? We have compromised brick and we should like to make it bear the blame for the disgrace which we have imposed upon it. Of all materials of construction it is the one that adapts itself most easily to all our conceptions, to all our fantasies; it has an incomparable flexibility, and if it is less capable than marble or wood of giving a certain air of grandeur or coquetry to structures inspired by no lofty or delicate idea, it is ever ready to reflect sincerely and eloquently all noble ideas and all ingenious thoughts. Without going back to the Assyrians, recall such striking and beautiful brick structures as the following: the caissons of the Basilica of Constantine or the Baths of Caracalla of Rome, the Giralda of Seville, the Roman Basilica of Saint-Sernin at Toulouse, the Gothic churches of Belgium or those of Lübeck, a wing of the Château of Versailles (Louis XIII), the Château of Blois, the inclosure walls of the Kremlin at Moscow, etc.

The use of brick as well as of concrete is becoming general. Both lend themselves to forms of great variety and meet the sometimes contradictory demands of different regions. They make it possible even to revive types which are disappearing and revive them without servile copying. They will maintain, if we wish, in the house and in the city their geographic originality while safeguarding their artistic value.

The Great Cities of the World Situated above 5,000 Feet (1,500 Meters)

We should further group city phenomena according to other similarities. We might, for example, compare the conditions of the large cities of the world situated above 5,000 feet (1,500 meters).[1]

In general in the countries of temperate Europe, human

[1]Louis Gobet made a study of this kind; unfortunately he was able only to formulate the question in a general article in the *Rev. de Fribourg* (January - February, 1913); at least from some of his pages and notes one can understand in what spirit the subject should be approached and what a remarkable study in comparative geography might be drawn from it.

establishments become more and more sporadic and the population less and less dense as we rise in altitude. Ratzel insisted upon this rarefaction in high altitudes[1] and cited the typical example of the distribution of population in vertical zones in the Erzgebirge:[2]

3,300–3,600 feet.....	15 inhabitants =	10.00 per square mile
3,000–3,300 feet.....	1,507 inhabitants =	146.20 per square mile
2,700–3,000 feet.....	6,440 inhabitants =	135.50 per square mile
2,400–2,700 feet.....	31,293 inhabitants =	113.20 per square mile
2,100–2,400 feet.....	63,291 inhabitants =	238.48 per square mile
1,800–2,100 feet.....	138,534 inhabitants =	334.89 per square mile
1,500–1,800 feet.....	172,190 inhabitants =	318.25 per square mile
1,200–1,500 feet.....	281,362 inhabitants =	496.01 per square mile
900–1,200 feet.....	512,346 inhabitants =	1,269.02 per square mile

In Switzerland, which is the country of Europe that has the highest average altitude, this altimetric or vertical distribution is verified; in 1888, only 5 per cent of the total population were living above 3,300 feet (1,000 meters), and even in a canton in the midst of the mountains such as Valais, 44 per cent only were above this limit. The canton of Grisons alone, which comprises, it is true, the upper valleys of the Rhine and the upper valley of the Inn (Engadine), has more than half of its population above 3,300 feet (1,000 meters). The altitudinal distribution of the population of the canton of the Grisons, based, as always, upon the distribution of dwellings and dwelling groups, is as follows:[3]

Zone of Altitude	Percentage of the Population of Grisons
Up to 900 feet.....	1.6
900–1,800 feet.....	20.7
1,800–2,700 feet.....	19.8
2,700–3,600 feet.....	18.4
3,600–4,500 feet.....	21.6
4,500–5,400 feet.....	14.0
Above 5,400 feet.....	3.9

Not even one-fifth of the habitations in Grisons are situated above 5,000 feet (1,500 meters).

[1]But the contrary may be found to be true in tropical mountains and plateaus. See pp. 189–196.

[2]Ratzel, *Anthropogeographie*, II, p. 210, and in general, chapter VII, pp. 209–222.

[3]Pierre Clerget, "Le Peuplement de la Suisse, Étude de géographie humaine," *Bull. de la Société royale belge de géographie*, 1906, No. 2, reprinted with additions in his book *La Suisse au XX^e^ siècle, Étude économique et sociale*, Armand Colin, Paris, 1908. See, from another point of view, R. v. Schlagintweit, "Über den Einfluss der Höhe auf den menschlichen Organismus," *Zeitschr. der Ges. für Erdkunde zu Berlin*, I, 1866, pp. 332–342.

At still higher altitudes, man treads vast snow fields and glaciers, and the tourist finds no other shelter than the isolated huts of the Alpine Club. Yet at the same altitudes in certain other parts of the globe, conspicuously in the tropics, are very dense groups of population and even important cities. Whereas the lofty plateaus in Europe have a restraining influence on human establishments, it is the high plateaus in other regions that have become the rallying points.

Consider the great plateau of Abyssinia in Africa: where are the chief cities? They are situated thus:

Harrar	at.....6,089 feet
Adua	at.....6,398 feet
Gondar	at.....7,447 feet
Adis-Abeba	at.....7,953 feet
Ankober	at.....8,530 feet

The populated zone is almost entirely between 6,000 and 8,500 feet in altitude.

If we cross the Red Sea to Arabia we find in the Yemen a city, Sana, situated at 7,054 feet (2,150 meters). The plateau of Iran offers us still more characteristic facts: Teheran, the capital of Persia, is situated at 3,707 feet (1,130 meters) and has 280,000 inhabitants; Hamadan, the ancient Ecbatana, shelters 35,000 inhabitants at 5,905 feet (1,800 meters); Ispahan at 5,200 feet (1,585 meters), has 90,000 inhabitants; and Kabul, one of the keys of India, which has nearly 150,000 inhabitants, is at about 5,905 feet (1,800 meters) altitude.

Let us take next the classic country of the great lamaseries. Going down the valley of the Tsang Po, we find the city of Shigatze, which has a considerable commerce with India; it is situated at 12,861 feet (3,920 meters). A little lower is the capital, Lhasa, with its huge convents inhabited by 20,000 Buddhist priests, and the famous Buddha-La (Fig. 95); it is situated at 11,647 feet (3,550 meters), that is at an altitude which surpasses that of any peak of the Pyrenees. Gyangtse is at 13,123 feet (4,000 meters) and Phari at 14,272 feet (4,350 meters).[1]

But the New World, extraordinary from so many points of view, will astonish us still more. Over a strip of land several

[1]See the study by J. Sion, "Le Tibet méridional," *Ann. de géog.*, January 15, 1907, p. 36.

thousand miles in length, extending from Mexico to Chile, we find that the populated zone remains constantly in the high regions. With the exception of a few ports on the Pacific, the most considerable cities are nearly always found above 6,500 feet (2,000 meters). The city of Mexico is situated at 7,730 feet (2,356 meters) and has a population of more than 470,000 inhabitants. On this same plateau is a series of cities, such as Leon, San Luis Potosí, Guadalajara, Puebla, all of which have from 60,000 to 100,000 inhabitants.

The same facts are repeated on the other side of the Isthmus of Panama. In Colombia, Bogotá, with a population of more

Photo sent by the Geographical Society of Petrograd and engraving kindly loaned by H. Busson

FIG. 95. THE BUDDHA-LA OF LHASA, AT AN ALTITUDE OF MORE THAN 11,500 FEET (3,500 METERS)

Mountain of Buddha (near Lhasa) on which are built the temples, palace and residence of the Dalai Lama.

than 120,000 inhabitants, lies at an altitude of 8,678 feet (2,645 meters), and many cities with a population varying from 10,000, to 20,000 are found on plateaus between heights of 5,906 feet (1,800 meters) and 9,842 feet (3,000 meters).

Toward the south the interior plateaus of the Andes rise in height and the cities follow the same upward march:

	ALTITUDE	POPULATION
Ibarra	7,293 feet	10,000 inhabitants
Quito	9,350 feet	70,000 inhabitants
Cuenca	8,464 feet	50,000 inhabitants
Loja	7,283 feet	10,000 inhabitants

In Peru the most inhabited zone lies between 4,900 feet (1,500 meters) and 11,500 feet (3,500 meters) altitude and most

of the cities are found above an altitude of 6,560 feet (2,000 meters):

	Altitude
Arequipa, with 35,000 inhabitants	7,874 feet
Cuzco, with 15,000 inhabitants	10,499 feet
Sicuani, the paradise of Peru	11,588 feet
Oroya	11,926 feet
Puno	12,664 feet
Crucero	12,959 feet

Finally, Cerro de Pasco, with 13,000 inhabitants, is at 14,270 feet (4,350 meters), more than a half mile above the timber line.

Let us close with Bolivia, where the Andes spread out and form a vast plateau:

	Population	Altitude
Cochabamba	30,000 inhabitants	8,399 feet
Sucre	29,000 inhabitants	8,858 feet
La Paz	100,000 inhabitants	12,139 feet
Oruro	22,000 inhabitants	12,188 feet
Potosí	29,000 inhabitants	13,123 feet
Huanchaca, which is growing in importance		13,452 feet

What gives these facts their particular value is that we are not dealing with a few habitations lost in the midst of snows or mosses and which would serve to shelter man only for some months of the year, but rather with flourishing cities whose population runs from 20,000 to 100,000 inhabitants and in certain cases reaches 450,000. This distribution of population is not a fleeting fact due to a chance circumstance. The high plateaus of which we are speaking have seen brilliant civilizations, which have disappeared in part to-day, it is true, but to the development of which certain monuments still bear witness. (The Aztecs in Mexico, the Medes and Persians in the Iran, the Quichua and the Aymara in Bolivia, and Peru under the rule of the Incas.)

Finally, as if to make the contrast still more striking, the region below 4,900 feet (1,500 meters) in altitude is, in general, very moderately populated.

What can be the cause of facts so contrary to those which we observe in European regions? Why has man withdrawn from the lower plain? Could it be perhaps the impossibility of finding upon an ungrateful and arid soil the resources necessary for his existence? No, that is generally not the case. In

most of these countries, almost all within or near the tropics, a hot sun combined with abundant rains favors an exuberant vegetation, and men can harvest almost without cultivation. Banana, cacao, coconut, vanilla trees and manioc bushes crowd the lower land. Man would find here material for lodging, food, and clothing, and yet none of these regions contains population groups of noteworthy density. Man has fled these plains where fever reigns eternally. Because of the location at or near the equator and the abundance of the rainfall, the temperature of a hothouse prevails, a moist and unhealthful heat, favorable doubtless to plant life, but almost invariably fatal to the European and dangerous even for the native.

In the *tierras calientes* of Mexico, of Central America, and of Venezuela people succumb to the attacks of fever, of the *vomito negro*. Vera Cruz, on the Gulf of Mexico, was long so unhealthful that the Mexicans themselves have called it *Ciudad de los muertos* ("City of the Dead"). The same dangers are found in Peru, where the coast region is unhealthful; in Arabia and in the Iran, where the regions along the coast are haunted by cholera; in the Abyssinian *kolla*, where the depths of the valleys are so filled with miasma that the inhabitants of the high plateaus do not descend below 3,200 feet (1,000 meters) during the rainy season.[1]

Driven from the plain, men sought in these countries more favorable regions; they had only to go higher up the mountain sides or to penetrate into the high plateaus of the interior to find abundant resources and a pure and healthful air.

In Mexico, leaving the hot and unhealthful lands of the coast, man had before him the temperate and the cold lands where the temperature is remarkably favorable. On these plateaus, more than 6,500 feet (2,000 meters) in elevation, the mean temperature for the year is 14° C. (57° F.); variations from one season to the other are much less marked here than in our own regions. The air is in general keen, dry, and salubrious; where water is not lacking the vegetation is rich. Here the greater part of the population lives and here, as we have seen, are found the most important cities.

[1]Exactly the opposite reason has prevented population of the southern coast of Peru and the northern part of Chile: the dryness of the air has made this region a desert.

We find identical facts in South America. The city of Popayăn, in Colombia, situated at 5,900 feet (1,930 meters) altitude, has a mean temperature of 17° C. (63° F.) Higher still, at 8,330 feet (2,540 meters), the city of Santa Rosa de los Osos, built on a plateau exposed to all winds, enjoys a mean temperature of 14° C. (57° F.) and a perfect salubrity. "No one dies here except of old age or by his own hand," according to a local saying. Quito, at about 9,350 feet (2,850 meters), but on the equator, has an almost constant mean temperature of from 13° C. (56° F.) to 15° C. (59° F.). The cities of Abyssinia, situated in the *voina-dega* or the *dega*, that is, at more than 6,550 feet (2,000 meters), have mean temperatures that do not remain below 14° C. (57° F.).

Great as its influence may be, however, climate cannot in itself explain the peopling of high regions; men must have found there resources permitting them to subsist and to develop. The products of the temperate regions of Europe are here found along with those of the south or equatorial regions, and this is the case for the greater part of the countries we have just noted.

If we penetrate to the high plateau of Mexico, at an altitude at which the Alps, subject to a polar temperature, produce hardly anything but mosses and Alpine plants, we see fields of barley, of wheat, of maize the stalks of which reach a height of 9 to 13 feet (3 or 4 meters); sugar cane is also found and the palm tree grows in the gardens of Mexico.

In Colombia the banana tree and sugar cane are found to an altitude of 6,500 feet (2,000 meters); higher still are fields of wheat, barley, and potatoes. Bogotá, situated at 8,530 feet (2,600 meters), on a plateau where trees are both scattered and poor, is surrounded by vast stretches which lend themselves to grazing and to the cultivation of cereals; the same thing is true on the high Andean plateaus of Ecuador, Peru, and Bolivia. On the Amazon slopes, because rain is more abundant there, the city of Tarma, situated at 10,007 feet (3,050 meters), has fields of coffee and sugar cane; Jauja and Huancayo at 11,150 feet (3,400 meters) gather abundant harvests of fruit and vegetables; finally Sicuani, at 11,500 feet (3,500 meters), one of the privileged and famous sections

of Peru, has broad fields of maize and numerous orchards.

The *voina-dega* of Abyssinia produces plants of the Mediterranean region: olive and lemon trees, the vine, maize, etc.; and up to 8,200 feet (2,500 meters) tropical plants as well: cotton, coffee, etc.; the *dega*, above 8,200 feet (2,500 meters), has pasture lands which feed large herds.

But there are inhabited regions higher still. In Peru and Bolivia, in particular, populations have grouped themselves at amazingly high altitudes. Thus La Paz, which has 100,000 inhabitants, and Oruro, which has 22,000, are situated above 12,000 feet (3,700 meters). Cuzco is at 10,500 feet (3,200 meters) and has 15,000 inhabitants. Potosí is at 13,100 feet (4,000 meters); it has to-day only 29,000 inhabitants, but at the time of the great mining operations there were as many as 150,000. Let us cite in closing, Cerro de Pasco, which has 13,000 inhabitants and is situated at 14,275 feet (4,350 meters). No peak of the Bernese Alps is so high.

At these altitudes the mountaineers contract diseases caused by the rarefaction of the air and the lack of oxygen. Almost all visitors who go up to Cerro de Pasco or to some other city of the high plateaus are attacked by the *soroche*, or mountain sickness, which seems to affect them in a different manner and with greater or less severity in different regions.

"Whatever precautions are taken in white families," says a traveler, "out of three children born at Potosí scarcely more than one survives beyond a few hours and is brought up with much difficulty. Those who reach man's estate would have been athletes in other countries and these chosen specimens at Potosí are able to form only a puny and stunted population."[1]

The water of the Puna de Atacama is almost everywhere salt; there is no drinkable water except in small streams before they come out of the mountains and in springs often 30 miles apart (50 kilometers). The climate is dry and rather cold; the temperature goes down almost below freezing during the night, even in summer. On the other hand, the sun is burning hot. The winter season lasts from June to August, the summer from December to February. According to a series of observations

[1]Reclus, *Géog. univers.*, XVIII, p. 681.

at Cochinoca (11,483 feet, 3,500 meters, altitude) the mean barometric pressure would be 19 inches (491 millimeters). In spite of this extreme rarefaction of the air the Indians of the high plateaus are capable of doing heavy work. On the other hand, newcomers suffer from oppression and palpitation of the heart at the slightest exercise.[1]

Even the high Bolivian plateau or *altiplanicie*, which is situated farther north, is strangely poverty-stricken. "Here and there are clusters of wretched-looking mud huts thatched with straw and set down upon a cold, semiarid, treeless plain. Moss and dry resinous bushes, of which the *tola* is the most numerous, are used as fuel, besides dry llama dung (called *taquia*) which is collected in the stone corrals of the mountain shepherds. Only the potato will mature. Barley and corn will not ripen, though they are raised in favorable sections for winter forage."[2]

These regions are relatively little inhabited:

Bolivia	has only 3.38 inhabitants per square mile
Peru	has only 6.6 inhabitants per square mile
Ecuador	has only 17.0 inhabitants per square mile
Colombia	has only 11.5 inhabitants per square mile

If we compare these figures with those furnished by certain countries of Europe or even North America, such as the high plateaus of Mexico, for example, we shall be forced to confess that these Andean republics are desert countries.

It is true that these low figures admit of some further explanation. It is to be noted first of all that there are here vast uninhabitable stretches. such as the chains of the Andes and even certain lower regions of the *costa* and of the *montaña*, too marshy or too woody.

It is certain, on the other hand, that it is not toward these high plateaus that the flood of European emigration turns in spite of the mineral riches which might attract adventurers. This is a very natural fact which we should find elsewhere. California, for example, in spite of an admirable climate and

[1]Dr. L. Laloy, "Ethnographie du haut plateau argentin," *La Géographie*, XXI, 1910, p. 172, after one of the volumes of the Mission scientifique, G. de Créqui-Montfort and E. Sénéchal de la Grange: Eric Boman, *Antiquités de la région andine de la République Argentine et du désert d'Atacama*, II, Le Soudier, Paris, 1908, 557 pages, 1 map, 51 plates, and 45 figures in the text.

[2]A. Dereims, "Le Haut Plateau de Bolivie," *Ann. de géog.*, XVI, 1907, p. 357.

a fertile soil, receives a much smaller number of immigrants than regions situated east of the Rocky Mountains. In South America the vast plains of Brazil and the Argentine Republic, which are rich regions and easy of access, can still receive millions of immigrants before they will be obliged to cross the Andes and install themselves among the high plateaus where they are, so to speak, separated from the rest of the world in spite of new roads. It is no small labor to fling railroads up mountain sides and across heights of from 9,800 feet (3,000 meters) to 13,000 feet (4,000 meters). One must reckon with the scarcity of water and the difficulty of all labor in such high altitudes. Engineers can do wonders if they are well supplied with capital, but after the road is built the bills must be paid. Man can conquer even the heights, but he wins at a price. Our boasted conquest of nature is after all a *conditional* conquest.

The Antofagasta-Oruro line over Chilian and Bolivian territory crosses the desert of Atacama and reaches an altitude of more than 13,000 feet (4,000 meters). The Callao-Lima-Oroya-Cerro de Pasco line, opened on September 28, 1892, has 63 tunnels and in a distance of 86.9 miles (140 kilometers) rises to 12,220 feet (3,725 meters); at three points it goes above 13,000 feet (4,000 meters) in altitude and reaches the highest elevation of any railroad on the globe: 15,663 feet (4,774 meters). The new Duran-Quito line reaches 13,451 feet (4,100 meters) and the Mollendo-Puno line, 14,580 feet (4,444 meters).[1]

Here as everywhere the way of communication accompanies the city. To the paradoxical city corresponds the almost paradoxical railroad. But here true "roads" are still more rare than "houses," and all future economic development can result only from a multiplication of the roads.[2] Now to raise ten tons to a height of 13,000 feet (4,000 meters) demands the same expenditure of coal or electrical energy in Andean America as in the Dauphiné or in the Engadine, and this so painful

[1] In connection with the great transandine routes, we recall that in 1910 they had completed and opened to traffic the Buenos Aires–Valparaiso line, the highest altitude of which is at 10,486 feet (3,196 meters) above sea level (*Scottish Geog. Mag.*, XXVI, 1910, p. 39).

[2] See the conclusions of the article already quoted, by A. Dereims, *Ann. de géog.*, XVI, 1907, pp. 358–359.

and costly a task of circulation will in itself very rigidly limit the development of these very remarkable agglomerations in high altitudes.

6. URBAN CIRCULATION AND THE FORTIFICATION. A FEATURE OF THE PHYSIOGNOMY AND GEOGRAPHY OF CITIES: THE "BOULEVARD" AS A FACT OF URBAN GEOGRAPHY

There is doubtless no human fact which has more quickly and powerfully changed "the face of the earth" than the recent and prodigious growth of cities. Let us look at the reality more closely; it is not a simple modification in appearance—it is a profound, a topographical modification, which turns aside streams, fills up depressions, levels reliefs, etc.[1]

Now what we have said of the necessity of grouping the material surface facts (which compose the large agglomeration) according to their analogies, we may say likewise of the parts which form this whole. That the reader may clearly understand our meaning let us try to detach one of these urban facts and show the interest that a comparative study of it might have.

The city street deserves to be regarded as a geographical fact as well as the road proper.[2] F. Ratzel, in the second

[1] See, for example, Hugo Hassinger, "Über einige Aufgaben der Geographie der Grossstädte, mit besonderer Berücksichtigung Wiens," *Geog. Jahresbericht aus Osterreich*, VII. On the other hand, Étienne Clouzot groups some typical facts as follows: "'Made land' and excavations have, in all regions, softened the relief of the soil. . . . The continual paving of streets and avenues has everywhere raised the level of the ground a little . . . . At Paris, the island of the Cité, which, according to P. Dupuy's expression, forms a breakwater in the middle of the Seine, has throughout its whole expanse been built up from 22 to 26 feet (7 to 8 meters). At Boston, of the three hills on which the primitive locality of Trimountain was established, there remain only two. Beacon Hill was leveled in 1795, to give place for the State House. The same is true of many water courses, small or great, such as the Flon at Lausanne: they disappear. Rivers have been turned from their courses, canals have been dug to conduct water through the city; then, when abuse or indiscriminate dumping reduced them to the rank of mere sewers, ingenuity was taxed to turn them back to their original course, to cover or do away with them. At Cairo, the Kaligh, diverted from the Nile and still in sight a few years ago, has totally disappeared to-day. At Paris, the Bièvre, conducted in the twelfth century to the neighborhood of the *Place Maubert*, in the fifteenth century reduced to the elevation of the wine market, and at the end of the seventeenth century restored to its original mouth not far from the Austerlitz bridge, has just been completely covered over and wiped off the map as a Parisian river. At London, the Fleet River is now nothing but a memory. Was it not but a short time ago that the Paillon at Nice was hidden from view, and at Paris a part of the canal Saint-Martin?" (E. Clouzot, "Le Problème de la formation des villes," *La Géographie*, XX, 1909, p. 174). See also Mark Jefferson, "How American Cities Grow," *Bull. Am. Geog. Soc.*, January, 1915.

[2] We have taken great pains never to separate the "urban road" from the road with no qualifying word at all, and that since the first glance at "The material characteristics of the street and the road" (see above, sec. 2, and especially Fig. 42, p. 111).

volume of his *Anthropogeographie*, has devoted an entire chapter, a chapter both geographical and philosophical, to *Wege* (roads);[1] what Ratzel has done for extra-urban roads which connect population groups may be attempted also for urban "roads." The multiplicity, the regularity, and a certain physiognomy of streets correspond to different stages in the development of civilization. In the same way a definite differentiation is the sign of a progressive evolution; the *carrefour* (crossroads), for example, is a type of urban "space," a passing intermediary between the street proper and the square proper, which tends inevitably to disappear.

Then, too, even the most modern cities, and older cities with all the more reason, are lacking in space set apart for the ever-increasing needs of circulation. There is no longer room enough for the excessive movement of individual or collective vehicles; the streets are too narrow. Just as human dwellings have been placed above each other, that is, just as the house has multiplied its stories in cities of restricted area, so do paths of circulation tend toward superposition, one above the other. Thus have arisen subterranean or elevated roads (New York, London, Paris, Berlin, etc.). The streets of the future will doubtless consist of several stories. Even to-day the basements of some New York stores near large subway stations have been extended to the subterranean road so that the subway traveler may here and there look into well-lighted exhibition windows, underground drug stores, and small shops of many different kinds.[2]

The great railroad systems penetrate as far as possible into the cities in close touch with the electric cars and the urban railroads. All these are problems which have a geographical aspect.[3]

What a truly geographical picture is that of the small and large streets in a typical city, such as Genoa, which has hardly

[1] *Anthropogeographie*, II, chap. XVI, pp. 525–526; and I (2d edition, 1899), *passim*, especially p. 129.

[2] Ellsworth Huntington, "The Water Barriers of New York City," *Geog. Rev.*, II, 1916, pp. 169–188.

[3] See, for example, Ernst Egerer, "Die Entwickelung der städtischen Personenverkehrsmittel," *Deutsche geog. Blätter*, XXIX, 1906, pp. 154–176); and a good chapter on "Les Moyens de transport urbain," in the 5th series of the *Mécanisme de la vie moderne*, by Vicomte d'Avenel (Colin, Paris).

had room to grow and none to change! What an abundance of small passages between the tall houses and what an abundance of varied names to designate their different kinds: *via*, street; *vico*, alley; *vico chiuso*, blind alley; *salita*, a little steep path; *scaletta*, little street in the form of a stairway; *corso*, courtyard; *mura*, rampart.[1]

In a large number of cities in Italy, Spain, France, Switzerland, Greece, etc., which are grouped upon heights or around heights, we find real stairways, covered or uncovered, or streets in the form of stairways; in the Mediterranean countries this is particularly frequent, as at San Remo, at Genoa, at Naples, at Girgenti (Fig. 96), at Jerusalem, and at Algiers. In the cities of the Middle Ages the street was rarely rectilinear and the houses along the street rarely in a straight line; cities of which certain quarters have kept their ancient character still furnish a living witness to this: Toledo and Cordova, Blois and Morlaix, Bruges and Ghent, Nuremberg and Ratisbon, etc.

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FIG. 96. A STREET OF STAIRS AT GIRGENTI (ANCIENT AGRIGENTE, SICILY)

These streets of stairs are accessible even to loaded animals, as can be seen by the mule which is completing the ascent of the steps.

In the way of example we shall merely call attention to the special characteristics of those roads which, in most cities in France, are called *boulevards*.

[1]See, on the names given to the principal streets of various large or small cities, an article in the Austrian review, *Zeitschr. für Schul-Geographie*, by L. G. Ricek, "Strassen," XXIX, 1908, pp. 371–377.

The "Boulevard," "Avenue," "Paseo," "Anlage," "Corso," etc. (in French, English, Spanish, German, Italian, etc.), that is, the broader city street often planted with trees, is a characteristic: (*a*) of entirely modern cities recently built (see in particular the plans of American and Australian cities, of Johannesburg, and even of cities somewhat less recent such as Berlin, Odessa, Petrograd); or (*b*) of the newly built parts of old cities (the new sections of Cairo, Barcelona, Brussels, etc.). In the largest cities of to-day there is an ever-growing need of laying out and reserving, in the monotonous checkerboard of streets cutting each other at right angles, some broader ways which become the main arteries of circulation.[1] But the "Boulevard," "Avenue," "Anlage," etc., although always of recent creation, may be of more ancient origin and may have therefore a richer historical meaning and more interesting geographical characteristics.

If we glance, for example, at a map of Paris, we are struck by the circular plan of that line of boulevards girdling the city which runs from the Bastille and the old Saint Antoine gate to the old gates of Saint Denis and of Richelieu: it is simply a plan of a part of the wall of Paris under Louis XIV.[2]

In fact, the "boulevard" represents very often the only part of ancient cities which, without too much demolition, could be changed into a broader street or series of streets; that is, it represents the line of ancient ramparts. These features of course often reproduce inexactly the ancient outlines of the fortification; the angles, the characteristic zigzags of certain types of ramparts, have disappeared to give place to a less complicated, less broken general direction; but these boulevards as a whole emphasize in a new form essential traits of a past that has vanished (Moscow, Cracow, Prague with its *Graben*, Vienna with its *Ring*, Milan, Trent, Bruges, Namur, Cologne,

[1] George G. Chisholm, the eminent English geographer, has stated: "It is, however, interesting to note that in ancient times cities were built with broad, rectilinear streets. The Roman colonies were built on the model of the Roman camps. An English city such as Chichester still bears, in this respect, the Roman imprint, although it was not really a 'colony.' Some Greek colonies of Asia Minor have the same characteristics."

[2] See the plan of *Paris à l'avènement de Louis XIV, d'après Gomboust, 1652*, and other plans of Paris at various epochs, such as Paul Dupuy has successfully brought together for comparison in the *Atlas Vidal-Lablache*, Maps 46*b* and 46*c*. See also the article by Paul Dupuy, "Le Sol et la croissance de Paris," *Ann. de géog.*, IX, pp. 340–358.

Saragossa, etc.). In France there are abundant examples of large and small cities which to-day have boulevards on the sites of their ancient ramparts: Amiens, Rouen, Chartres, Dijon, Auxerre, Montluçon, etc. We shall call attention particularly, as showing this geographical fact in a distinctive manner, to the little city of Brive (Fig. 97) and to that of Beaune.

An important characteristic of the city is the fortification which shows itself by walls and by the hollows of canals. What is the fortification but the contrary of the road, the

FIG. 97. BRIVE (FRANCE); THE BELT OF SHADED BOULEVARDS ON THE SITE OF THE ANCIENT RAMPARTS

Type of boulevard of historical character, the design of which preserves a former feature of urban physiognomy, that of the fortifications.

geographical expression of the struggle against circulation? An urban center, because of this inevitable bond between its construction and the paths of communication, must be rich in

ways of approach, and in so far as it profits from such abundance it is obliged to protect itself against the dangers of possible invasion and surrounds itself with works of defense.

The most unpretentious facts of circulation on the earth

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FIG. 98. AT CHÂTEAU D'OEX. A FENCE MADE OF SPLIT RAILS DRIVEN INTO THE GROUND AND CROSSED

This very pretty type of fence was photographed in the mountains of Switzerland, and is quite common in Swiss and Austrian alpine regions; by its character it belongs to the geographic nature of forest zones, and it even uses up so much wood that in certain districts in Austria there is a movement to replace these natural and geographic fences by barriers of other materials.

are accompanied by other unpretentious facts of defense against "invasions" of circulation; pastures, fields, or gardens are inclosed with fences or walls. These fences or walls might be studied, from the geographical point of view (Figs. 98, 99), in their mode of construction and their distribution just as we must study the most striking and colossal "contradictions" of circulation: the Great Wall of China or those walls of several miles in length in the south of Russia on the banks of the Dnieper (*Smievy Vali*, [ramparts of the serpent], *Veliki Val*, etc.), the entire collection of old cities surrounded by walls and notably those which are still in existence, cities dead yet still alive, marvelously preserved jewels such as

FIG. 99. THE WALLS WHICH INCLOSE THE GARDENS OF DAMASCUS

In the magnificent oasis of Damascus, the wood of the fruit trees is too valuable to be used in making fences; instead broken stone from the cones and from the terraces of the seven-armed Barada River furnished the essential elements for a sort of concrete out of which are made the large slabs that are used in building the protecting garden walls.

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FIG. 100. GATES, WALLS, AND TOWERS OF OLD AIGUES-MORTES

What gives special interest to this city, the walls of which are so perfectly preserved, is that inside or in the shadow of these walls and towers still live some hundreds or thousands of inhabitants. The city is nearly dead, like a museum specimen, but in the center of all these masses of stone, now without use or reason, life endures, though reduced and diminished.

Aigues-Mortes or the old city of Carcassonne (Figs. 100 and 101), and finally the fortified castles of former times and the strongholds of to-day.

We might undertake, in the same spirit, a critical geographical comparison between the numerous castles of France.

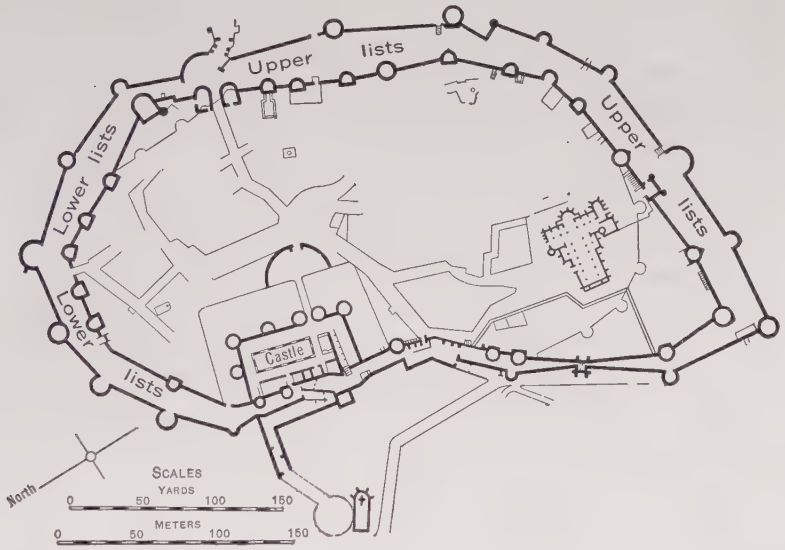

FIG. 101. A CITY DEAD YET ALIVE: AN EXCEPTIONAL TYPE OF FORTIFICATIONS FOR DEFENSE AGAINST CIRCULATION. PLAN OF THE CITY OF CARCASSONNE, BY MICHEL JORDY

A thousand inhabitants still live inside the walls, where the castle and the great church of Saint Nazaire are located. The wall is double: the line of the interior wall is 3,609 feet (1,100 meters) in length; the exterior wall is 4,921 feet (1,500 meters). Between the two there is a protected and continuous circulation zone called "lists": "upper lists" and "lower lists"; in reality the two walls and the lists constitute a sort of city apart, completely separated from the interior city, and equipped to house and feed all the defenders (bake-houses, store-houses for food, etc.) At each gate are various defensive works. It is a real museum of the art of fortification, of which certain parts go back to the era of the Romans, of the Visigoths or of the Arabs, while others belong to the feudal or royal era. Here, one over the other, are the traces of more than a thousand years of history (from the first centuries of our era to Saint Louis and Philip the Bold in the 13th century.)

According to their purpose and their date, each has taken advantage of certain natural facts, isolated heights, terminal tongues of lava flows, edges of plateaus, marshes or water courses, etc. Instead of examining the existing or ruined castles from the historical or artistic point of view, as has often been done, it would be interesting to introduce into this type

of questions a principle of coördination that would be properly geographical. For this purpose, France, with its long historic past and the astonishing geological and geographical variety

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FIG. 102. TYPES OF ELEMENTAL AGGLOMERATION AT THE FOOT AND IN THE SHADOW OF A CASTLE: SAILHANS (DEPT. OF CANTAL)

On the spur of basalt attached to the plateau of Planèze (arrondissement of Saint-Flour), stands an old castle which has been recently rebuilt and enlarged. A village of some houses has grown up at the foot of the short but steep slope, so well adapted and as if predestined for the establishment of a defensive post. Other houses, like those shown here, and even a little more numerous, border the foot of the rock on the other side.

There are several other places of the same type at the end of lava-flows in the heights of the Auvergne Mts.; see M. Boul and L. Farges, Dept. of Cantal, Guide for the Tourist, Naturalist and Archaeologist, Paris, Masson, 316 p., 85 illustrations and 2 maps in color.

of its soil, would offer a field and a material of high value.

Such researches would have an import all the more general because many villages and cities have sprung up or developed later in the shelter of and sometimes literally in the shadow of a castle[1] (Fig. 102).

We have just thrown in purposely a sort of parenthesis in order to show once more how timely and how rich in results would be the study of the phenomena of human geography

[1]On the complex, varied, and continuous rôle played by the châteaux, see E. Clouzot, "Le Problème de la formation des villes," *La Géographie*, XX, 1909, pp. 170–171, as well as Camille Jullian, "Les Villes fortes de la Gaule romaine," *Journal des savants*, February, 1908, pp. 72–79. See also A. Vacher, "Montluçon: Essai de géographie urbaine." *Ann. de géog.*, XIII, 1904, pp. 121–137 and Plates V and VI.

from their embryonic to their developed forms. The divisions in categories founded upon dimensions are much less instructive than "organic" divisions. If in the city the great fence of the rampart is bound to the road which it is destined to keep watch over or even to oppose, Fig. 98 shows also how the rudimentary fence and the smallest road, the path, are already associated.

Let us return to the relations between the city fortification and circulation.

It will be interesting to study the historic type of boulevards in different countries. In Germany the types representing the different stages of the change seem exceptionally varied and numerous.

First of all, certain German cities, like the cities just mentioned, have visible traces of their ancient ramparts shown in the modern city by a belt of wide streets. At Dresden the ancient zone of fortifications is to-day marked by bands of great streets in two parallel lines. From this circular zone, running from the center toward the circumference, radiate broad, straight streets—Wettiner Strasse, Prager Strasse, Grunaer Strasse, etc.—boulevards with no historic value—which, diverging from one another with geometrical regularity, stretch away to those new sections where the street is planned before building begins, where the street precedes the house.

Dresden is then a good specimen of an ordinary type which is frequently met with outside of Germany. But there are many other German cities which, from our present point of view, are rather original. It should, moreover, be noted that in general the name *boulevard* does not exist in Germany. This is rather a curious fact, for the word is of Germanic origin, and in its etymological meaning, *bollwerk*, recalls the historical genesis of this geographical feature of modern cities.[1]

In German cities on the site of the ramparts we find but rarely a street, properly so called, extending between two rows of houses as at Dresden; but we find rather a promenade which often bears the name of *Anlage* or of *Promenade;* sometimes, but much less often, the name of this promenade is

[1]It is for this very reason that it seems well to us to adopt it as a general term, covering all the different terms which serve to designate the same fact.

Avenue, the name more particularly used in English or American cities. Finally, it sometimes happens that transformed parts of the ramparts have kept the name of *Graben*.[1]

But where the phenomenon becomes more typical as a geographical fact is this: The promenade remains often at the level of the ancient patrol road, 9, 13, or 16 feet (3, 4, or 5 meters) above the city which it surrounds. At Lübeck and at Stargard in Pomerania, for example, the former ramparts have not been leveled and the *Wallstrassen* dominate these cities. At Göttingen the ramparts form a promenade, a celebrated "walk" near which is seen the house in which Bismarck lived as a student.

At other times the moat, if not the embankment, of the ancient fortifications has been preserved. This moat exists more or less entire at Ratisbon, at Nuremberg, etc.; it is, moreover, accompanied by a road which follows it sometimes on the side toward the city, sometimes on the other side. Finally, the physiognomy of this type of "boulevard" is completed by walls, when they have been preserved, as at Nuremberg. It is seen that this type approaches very closely to the ancient ramparts themselves, but it is already a "boulevard." If the type were more perfect—if, for example, instead of being dry and occupied by the market gardens at Nuremberg, the moat were still filled with water like the famous *Graben* of the Oker, at Brunswick, and if there were no recent transformation for the sake of traffic—we could hardly speak of a new kind of road. We should have before us the ancient historic city, carefully preserved; we should no longer have to do with the boulevard, but with a rampart, and that would belong rather to the geography of fortification.[2]

[1]So it is at Frankfurt-am-Main: a little skating pond is called *Bechner Graben*. The ramparts of Frankfort have been replaced by *Anlagen* which follow the ancient angular design of the walls; and the old ramparts develop in proportion as there are places where remains of them still exist with vestiges of old moats before them. Similar observations could be made about many of the cities of German Switzerland.

[2]If one could go into great detail, one would take pains to distinguish between the cities which have long since spread beyond the boundary of their encircling walls and those which are still shut up within that circle, like Brunswick (following the example of Aigues-Mortes and of Carcassonne; it is, in fact, a question of examining two quite different cases: the deliberate change of the ramparts, accompanied by that desire which people have to-day to preserve ancient things, and the natural transformation, such as took place at a period when no care of that sort was exercised.

We have said enough to indicate the fundamental difference between the two types of boulevard: the type which is generally rectilinear and the type usually winding or more or less completely circular.

Certain cities which are without parks will perhaps have the unexpected good fortune to obtain air, trees, and open

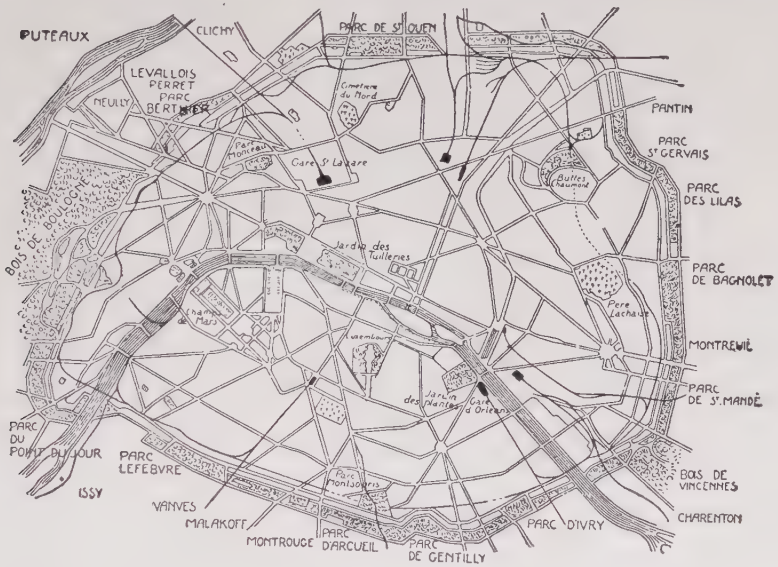


FIG. 103. THE PLAN OF THE FUTURE BELT OF PARKS IN PARIS ON THE SITE OF THE PRESENT FORTIFICATIONS AND MILITARY ZONE

spaces by the transformation of their belt of fortifications. Paris is much less rich in public gardens than London;[1] but an imposing project, practical and beneficent, plans to transform the zone of fortifications and part of the military zone into a chaplet of playgrounds and parks, eleven in all, four of which are to be of large size (Fig. 103). If Paris some day receives this magnificent and peaceful halo of green she will owe it to the material precautions and guarantees which, through long years, threats of siege and invasion have forced her to take.

[1]See on this subject Eug. Hénard, "Études sur les transformations de Paris," brochure 3, *Les Grandes Espaces libres; les parcs et les jardins de Paris et de Londres*, H. Champion, Paris, 1903, reviewed and in part reproduced in *La Géographie*, IX, 1904, pp. 197–204.

7. THE GENERAL GEOGRAPHY OF CIRCULATION

Through these several lines of approach we are brought once more to the general geography of circulation. This phase of human geography has certainly received the fullest and best treatment. It is besides the core of economic geography, which hitherto has received more attention as a whole than human geography. Hence we need note here only its cardinal points.

Can and must all economic facts touching on circulation, including even cost of transportation, commercial treaties, and free ports, be connected with the geography of circulation? And yet there is a method of studying, from the geographical point of view, even such complex problems as the international use of transalpine routes of travel and trade.[1] Geographers cannot forego their special part in such discussions nor their own particular interpretation of the physical and economic facts which are connected with the establishment of roads with greater or less gradients, the boring of great tunnels, the choice of certain routes.

If it is a question of maritime circulation, the decisive predominance of the commerce of the Atlantic Ocean surpasses all other considerations. In 1903, according to Max Eckert, the commercial shipping of the world involved 46,000 vessels, with a registry of 2,723 million cubic feet[2]; 44,000 vessels (of which 17,000 were steamers), with a registry of 2,645 million cubic feet, belonged alone to the Atlantic Ocean and what might be called its maritime dependencies.

In general, "for about twenty-five years vessels and ports have been passing through a crisis of growth the intensity of which surpasses the boldest prophecies and upsets all calculations."[3]

[1]See Jean Brunhes, "La Question des voies d'accès au tunnel du Simplon," *Rev. écon. internat.*, October 15–20, 1904, and especially "Les Relations actuelles entre la France et la Suisse et la question des voies d'accès au Simplon," 55 pages and 9 maps or charts (a study which first appeared in *Rev. écon. internat.*, February 15–20, 1906), the conclusions of which agree with the results of the two international conferences of Berne in 1909 and with the clauses of the two international conventions which have resulted from it.

[2]Max Eckert, *Der atlantische Ocean als handelsgeographisches Mittelmeer betrachtet*, Ratzel Gedenkschrift, Seele & Co., Leipzig, 1904, pp. 41–60.

[3]Louis Fraissaingea, *Le Problème de la marine marchande*, Larose, Paris, 1909, p. 2. See the documents, observations, and just conclusions which Marcel Dubois has gathered together in *La Crise maritime*, Guilmoto, Paris, 1911.

This is particularly true if we take under consideration the *regular steamship lines*, which J. Russell Smith, in his article on the "Organization of Ocean Commerce," separates into four groups:[1]

1. The fast passenger lines, whose freight business is merely incidental to their main purpose. Superiority in speed or at least regularity of speed is their first and almost their only aim. The North Atlantic Ocean is the predominant and even omnipotent center for these lines especially, and it is for the North Atlantic service that these gigantic human dwellings, provided with all the necessary equipment for practical, intellectual, artistic, sporting, and social life, have been constructed.[2]

2. The freight lines, less fast but less expensive, having a great relative importance in ports which do not seek to hold the first place in the transportation of travelers.

3. Lines of steam navigation which are prolongations of railroads; where the railroad ends at a port which is the center of numerous lines of navigation, the railroad company does not think of establishing a line for its own service and correlated with its own service. "New York has no transatlantic line which is a prolongation of a railroad, while Philadelphia, Newport News, Pensacola, Portland, and Boston all have them." The Canadian Pacific maintains lines to Great Britain, a line on the Great Lakes, and a very important line of navigation from Vancouver to Japan, China, and Hong Kong.

4. Private or industrial lines of navigation, destined primarily and sometimes even exclusively for definite kinds of transportation, of which a very striking example given by

[1]See J. Russell Smith, "Les Transports océaniques," *Rev. écon. internat.*, March 15–20, 1911, pp. 446–469; *The Organization of Ocean Commerce*, "Publications of the University of Pennsylvania, Series on Political Economy and Public Law," No. 17, 1905.

[2]The giant of the world was the *Titanic*, which, like the *Olympic*, belonged to the White Star Line. At the time of its first passage from Southampton, to New York in the night between the fourteenth and the fifteenth of April, 1912, it collided with an iceberg and sank. Of the 2,200 passengers and crew of this veritable floating city, only a third could be saved. The *Titanic* measured 979 feet (268 meters) in length and displaced 51,037 tons; it cost $8,878,000 (46,000,000 francs). In 1913 the German company Hambourg-America launched the *Imperator*, with 55,115.5 tons displacement. In April, 1912, the Compagnie générale transatlantique placed in service the largest of its packets, *La France*, of 29,762 tons displacement, 712 feet (217 meters) long, capable of carrying 2,529 people, crew included.

J. Russell Smith is that of the importation of bananas into the United States.

This fruit forms by far the most important exportation in quantity from the Central American coast, Jamaica, and Colombia, and there are numerous ports which export almost nothing else. Moreover, it requires vessels of peculiar construction and with a speed rather superior to that of the tramp steamer. The perishable character of the fruit necessitates very careful organization for its handling and delivery in good condition,[1] factors which have served to bring about a consolidation of the business and the use of more than a hundred vessels by a single company which has a number of lines between ports of the United States on the Atlantic and the Gulf of Mexico and the banana ports of the different coasts of the Caribbean Sea. In this particular case consolidation has gone still farther; the company has found itself obliged to buy plantations, to cultivate bananas for transportation by its steamers, and to build railroads to transport the banana from the plantation to the port. Then, thanks to the speed of the banana vessels, it is easy to add a few cabins for passengers. Finally, the attractions of the coasts of the Caribbean make them a favorite objective point, so that a transportation company for bananas has become, to a certain extent, a transportation company for travelers. To care for the travelers it has had to build hotels and thus complete a considerable group of industries centering about a particular enterprise in steam navigation.[2]

But if we should examine carefully maritime circulation on the globe as a whole, we should see alongside all these regular lines the literally innumerable multitude of isolated boats, vagabonds, tramp steamers, which, for the transportation of merchandise, are the formidable competitors of the regular boats.

The larger part of the world's freight comes from numerous little ports, often unknown to all those whom the nature of this freight does not directly interest. These small ports habitually load for only one direction, and often only one or two articles, ordinarily raw materials.

Thus Galveston (Texas) exports by sea twenty times as much freight as it receives by sea, and the vessels leaving this port for foreign lands are almost as numerous as all those leaving the United States for South America; Brunswick (Georgia) exports large

[1] On the general import of this question, from the point of view of circulation, see Henri Hitier, "Le Progrès du commerce international des denrées périssables," *Ann. de géog.*, XXI, 1912, pp. 109–117.

[2] *Rev. écon. internat.*, March 15–20, 1911, p. 463.

quantities of building wood, as does Humboldt (California), while the insignificant localities of the custom house district of Pearl River, which has less than 100,000 inhabitants and of which the commerce almost exclusively consists of 350,000,000 feet of building timber per year, export more than 350,000 tons of maritime freight per year — a figure almost equal to that for Portland (Maine); Tampa (Florida) exports numerous cargoes of phosphate and Norfolk exports coal, while Santiago (Cuba) exports hundreds of thousands of tons of iron ore per year. The characteristic of hundreds of small ports scattered over the world is to load entire cargoes of one or two articles only for countries importing raw materials. The ports for building timber in the Gulf of Mexico have their counterpart in the Baltic, and the West Indian ports which exist on ore shipments have their counterparts in those of the Mediterranean. Besides the fact that small ports load great quantities of one or two commodities only, the organization of the traffic is made still more difficult by the irregularity of the season. Thus the wheat at Galveston is ready to be exported before that at Montreal; the season differs again for the Argentine, California, and the Indies; Hawaiian sugar is loaded at a different time from Java sugar, and the Cuban season differs from the season of German exportations. The season for loading cotton follows immediately after its harvest season, and even mineral sodium nitrate has its rush season because of its large consumption by establishments which manufacture fertilizers to be used in the spring sowing season of the Northern Hemisphere. The transportation of building timber from the regions of the Baltic (northern Europe) to the consuming countries of western Europe gives rise to a traffic reaching more than twelve millions of tons per year and far surpassing in quantity the exportation of grain from America. Almost all the ports of the Baltic being blocked in the winter, nearly all of this transportation must be done in the warm months of the year.[1]

And yet, for very many of the heavier products, like iron ore, coal, etc., the time and duration of transportation are almost matters of indifference. These are the materials that aid preëminently in making up the cargoes of "tramps," which, according to their need and the necessity of stops, can offer reduced tariff.

In the matter of the well-known rivalry, upon which there are such widely different comments, between the railways and the waterways, there are still facts which force themselves upon the attention, whatever be the conclusion that we may wish to draw from them.

[1] J. Russell Smith, "Les Transports océaniques," *Rev. écon. internat.*, March 15 20, 1911, pp. 477–479.

Yves Guyot has tried many times to show that a crisis in transportation by water exists everywhere. In England railroads are being used more and more. In the United States the phenomenon is still more striking. The Mississippi and the Missouri, a wonderful navigable system of nearly 6,210 miles (10,000 kilometers) in length, are becoming less and less used.[1] Ask any railroad man about the Mississippi and he will tell you that on account of its floods, the expense of bridging it, and the difficulties raised by terminals at towns on its banks, he would wish the "Father of Waters" into oblivion![2]

This deterioration in river commerce is increasing; there are now few boats on the Missouri. It should be added, however, that the Panama Canal makes possible a productive renewal of the entire system of navigation of the Mississippi and that the central and southern states are not neglecting to prepare for it.

The United States has also in the north an admirable inland sea, a "Mediterranean," formed by the Great Lakes. From July, 1914, to July, 1915, out of a net tonnage of 8,389,429 tons for the commercial fleet of the whole country, more than two millions of tons (2,818,009) belonged to the Great Lakes, while the maritime tonnage was more than five million tons (5,432,616).

River traffic, properly speaking, is caught between the double necessity of being closely connected with maritime navigation, that is, of allowing few transshipments, and of having at its disposal in the interior good water stations to which railroad lines run. But it has in its favor the incomparable advantage of cheapness for the transportation in bulk of heavy material.

For quick transportation of travelers and mails the boat is being replaced by the railway; for example, the Indian Mail. In the second place, there is a tendency to avoid all transshipments by running an entire train upon the deck of a

[1]Guyot, *La Crise des transports*, Paris, 1908, and "Problèmes des transports, La voie d'eau et la voie de terre," *Rev. écon. internat.*, August 15 20, 1908, pp. 235–256.

[2]Isaiah Bowman, "Water Resources of the East St. Louis District," *Ill. Geol. Survey*, Bull. No. 5, 1907, pp. 4–6.

properly adapted vessel called a ferry-boat, as for instance the quicker communication between the Danish Islands and the Continent. This sort of advantage in favor of rapid land circulation is so great that the chains of small islands which form a continuation of Florida have been joined by a continuous railroad and that now the 180 miles of ocean railway make it possible to reach Key West from the mainland without changing cars.

Finally, in the matter of external and internal commerce, there exist striking differences between new countries and old countries with an ancient civilization where each district, for long centuries, has had to strive to be self-sufficient in the production of the necessities of life. In the young and new countries, on the contrary, specialization on a large scale in cultivation and in all productions is the rule. In the United States, for example, entire sections justly deserve the names of cotton belt or corn belt; thence comes an indispensable exchange between the different provinces that is striking in bulk and activity. Much more so than in the European states, interstate commerce by far surpasses foreign commerce. The statement is made by American schoolbooks, wrote H. Hauser in 1905,[1] that "our own products, transported from one point of the country to another to be sold at home, are worth about twenty-eight billions of dollars per year, or thirteen times the value of all our foreign commerce." The same idea may be expressed by saying that every citizen of the Union buys forty dollars' worth of domestic products to one dollar's worth of foreign.

Geography will find a place in all these questions which concern commercial routes,[2] not as furnishing the only data but often the fundamental data, and as explaining the establishment and development of the points chosen by man as points of contact between circulation by water and circulation

[1] H. Hauser, "Le Commerce intérieur aux États-Unis," *Ann. de géog.*, XIV, 1905, p. 94.

[2] See the following: George G. Chisholm, *Handbook of Commercial Geography*, seventh edition, with an additional chapter on "Trade Routes," London, 1908; also, for an article on the geographic rôle of railroads, Hugh Robert Mill, "The Development of Habitable Lands: An Essay in Anthropogeography," *Scottish Geog. Mag.*, February, 1900, p. 128. See also George G. Chisholm, "The Geographical Relation of the Market to the Seats of Industry," *Scottish Geog. Mag.*, April, 1910, especially pp. 176–177, and "Inland Waterways," *Geog. Jour.*, July, 1907.

by land.[1] There are ports and ports, and there are many ways of looking at and representing their value, their technical condition, and their zone of influence.[2]

If a port such as Hong Kong handles, counting the total entries and departures, about as many tons of merchandise as London or Antwerp, and three-fourths as many as New York,[3] that fact cannot fail to have a very great significance and we must imagine what such an *entrepôt* represents at the entrance and outlet of the more populated zones of the world; but that cannot be the only measure of economic reach and power. Thus in the history of the towns of the Hanseatic League[4] there has not always been a rigorous correspondence between the bare statistical facts of a port and its historic or geographic significance. It is nevertheless true that, the farther we go, the more the numerical expression of gross tonnage becomes the mark and, as it were, the standard of economic or even political victories.

The more the processes of technical construction are perfected, the larger become the units of maritime traffic. The more colossal these units become, the smaller in number are the large ports. Ports are like clothes; they must not direct or stop growth — they must submit and conform to it. All history shows us, as a strict application of this law, a progressive decrease in the number of the great available ports, true centers of economic influence. For the vast volume of maritime traffic and for the huge vessels which are the manifestation of this colossal traffic, there are fewer ports to-day than there were yesterday; there will be fewer to-morrow than to-day. This is a formidable prospect for nations which possess only numerous medium-sized ports, but it is a prospect

[1]See the collection of monographs published by the Scientific Society of Brussels on "Les Ports et leur fonction économique," Louvain, 1906, 1907, etc., and a number of regional, or special, studies: Arthur Raffalovich, "L'Amélioration des ports en Russie," *Assoc. internationale de la Marine, Congrès de Copenhague, 1902*, Paris, 1902, pp. 831-837; Paul de Rousiers, *Les Grands Ports de France, leur rôle économique*, A. Colin, Paris, 1909; etc. See also Ellen Churchill Semple, *Influences of Geographic Environment*, London, 1911, pp. 263–264, and chaps. VIII and IX.

[2]See, for example, Paul Langhans, "Die wirtschaftlichen Beziehungen der deutschen Küsten zum Meere," diagram on scale of 1 : 1,500,000, *Petermanns Mitt.*, XLVI, 1900, Vol. X.

[3]Albrecht Penck has published a remarkable discussion of New York harbor, "Der Hafen von New York," in the collection *Meereskunde*, IV, Berlin, 1910.

[4]Ellen Churchill Semple, "The Development of the Hanse Towns in Relation to Their Geographical Environment," *Bull. Amer. Geog. Soc.*, Vol. XXVI, 1899, No. 3.

which is the result of a sort of unavoidable necessity both material and geographical.

If we extend the domain of geography too far, we run great risk of leaving it altogether and running more than once into political economy and history. The *Politische Geographie* of Ratzel would require reservation on this point in more than one place. Just because a certain "geographical spirit" ought to inspire certain studies, it does not follow that such studies must be incorporated into geography — even human geography.

G. A. Hückel, in coördinating them, has made a remarkable résumé of a good share of the *properly geographical* theories of Friedrich Ratzel on the general geography of circulation.[1]

Modern progress in the ways and means of communication[2] has determined:

1. The multiplication of roads.
2. Their development with regard to distances reached, as an effect of great discoveries.
3. Their reduction to the shortest lines.
4. The substitution of regions imposed by nature for regions and points accidentally chosen.
5. The increase in extent of the space conquered and the increase in the possibility of transportation in bulk.
6. The transportation of a large part of the continental traffic by river or sea; and for the systems of river traffic, the cutting of transverse canals from one basin to another.

There is scarcely need of insisting on the originality of this theory, a theory as complete as that in reference to the evolution of a river system, and with which it has many analogies though there are also many important differences.

The comparison does not stop there. Corresponding to the period of old age in a river system is the period of decadence

[1]Hückel, "La géographie de la circulation selon Friedrich Ratzel," *Ann. de géog.*, XV, 1906, pp. 401–418, and XVI, 1907, pp. 1–14. See also the important articles by A. Hettner in Vol. III of the *Geog. Zeitschr.* (1897) under the title "Der gegenwärtige Stand der Verkehrsgeographie."

[2]See also Alfred de Foville, *La Transformation des transports et ses conséquences économiques et sociales.* See also the report by E. Levasseur, *Des changements survenus au XIX^e^ siècle dans les conditions du commerce par suite du progrès des voies et moyens de communications*, a report presented to the International Congress of Economic and Commercial Geography, 1900, Paris, Society of Commercial Geography. On the development of means of transportation, consult the posthumous work, by Ferdinand von Richthofen, *Vorlesungen über allgemeine Siedlungs und Verkehrsgeographie*, edited by Otto Schlüter, Dietrich Reimer (E. Vohsen), Berlin, 1908, pp. 16–352.

in commercial routes; it may be either the breaking up of the system by the exhaustion of the main artery of circulation which completely destroys the strength of the small arteries, or it may be, on the other hand, the weakening of the smaller routes through the gradual diminishing of population thus causing them to cease to feed the main channels of trade. The great arteries consequently weaken or disappear entirely.

The many parts of a great system of trade routes are as delicately interrelated as are the many branches of a river system. A quickening of movement in the central artery has the effect of accelerating the movement in all the tributary lines. The opening of the Suez Canal and of a trade route by way of the Mediterranean and the Red Sea caused the creation and improvement of railroad lines crossing the Alps, the boring of the Saint Gotthard tunnel, the use of more powerful engines, and an increase of speed upon all the systems of Europe north of the Alps.

The law of the "historic movement" is likewise a law of constant increase in rapidity of communication.[1] The transition from one mode of locomotion to another has of course not taken place without sudden jerks, but the harmony of a higher law has never failed to soften these transitions. After the establishment of railroads, the highways of Europe did not cease to be alive, and the activity upon them has even gained in importance in so far as they are properly adapted to the new system and feed the traffic of the railroads.[2] In Siberia, on the contrary, the railroad, by taking the place of a system of traffic which used only a few sections of the highways, has caused a revolution by putting an end to the long caravans bearing tea, silk, etc.

Transit and "entrepôt" countries (*Stapelländer*).—The peoples that are most backward in developing their own trade grant to foreign merchants certain trade privileges. Some nations have awarded to themselves the privilege or the monopoly of trade; others have limited themselves to the rôle of intermediaries or middlemen. Here we find once more the transit region already mentioned; in certain cases the entire country plays the part of a market. In the

[1]Ratzel refers here to the work by W. Goetz, *Die Verkehrswege im Dienste des Welthandels* (Stuttgart, 1888), where the subject of circulation has been treated by the purely historical method (criticized by A. Hettner, *Geog. Zeitschr.*, III, 1897, p. 625).

[2]Add to this the development of automobiling and cycling, which have revived the incomparable value of the system of roads which France established in the first half of the nineteenth century. See the Minister of Public Works, *Album de statistique graphique de 1900*, Imp. nat., Paris, 1906, Plates 2 and 3.

countries which Ratzel calls so strikingly *Stapelländer* or *entrepôt* countries (anciently *étaples* or landing-places), the inhabitants receive the imports and transport them at the farthest from one frontier to another. There were thus successively distinct series of numerous intermediate stations. In the Middle Ages, Arabia, Armenia, Persia, Greece, Italy, France, Flanders and Bruges,[1] and north Germany played this part of transit regions. The effect of each new development was to eliminate (*ausschalten*) an intermediary that had become superfluous and thus to cause the ruin of a commercial city or state (the Hanse towns, Flanders and Venice, which rose again at least as maritime powers, the Sabæans, the Bulgarians, the Armenians). In ancient times the enormous distance between the different centers of civilization favored the multiplicity of regions of transit: Arabia and Asia Minor. The Semites and the Greeks were, like the Italian republics in the Middle Ages, the great middlemen of commerce.[2]

It is particularly important in such a study to consider the following three types of regions in their distribution—exporting areas, importing or market regions, and transit regions. We can also divide the world into regions having analogous or slightly differentiated characteristics as far as the ways and means of transportation are concerned; these are the *Verkehrsgebiete* or trade regions.

We can also consider the progressive development of trade and the new conditions, regional or local, which arise from it, in the same *provinces* of human geography. There are modes of traffic which result from the means utilized. A railway is by definition fixed; the train is bound to a fixed route and fixed stations; it must discharge or transship merchandise at its stopping-places. What a revolution this is in comparison with the ancient means of transportation, which were more primitive but also more pliable! The camel walks slowly, but he can be brought directly before the hut, the tent, or the bazaar of the one who desires the products he carries. It is facts of this sort which explain the resistance, not without reason, of certain groups to the progress of locomotion. For many years a group of camel caravans held in check the railroad company from Beirut to Damascus and confiscated to its own profit a large part of the traffic.

[1]Raoul Blanchard, *La Flandre*, Danel, Lille, 1906.

[2]Hückel, article quoted, *Ann. de géog.*, XV, 1906, pp. 412, 413.

We might further consider the very skillful adaptation to geographical conditions of the birch-bark canoe in the North American forest or of the sealskin *kayak* of the Eskimos, a slender skiff which seems one with its occupant,[1] or of the *pirogue* with its outrigger (Fig. 104); or the important part played by the wheeled cart or wagon, that marvelous instrument of transportation which was known in ancient times only in southern Asia (Fig. 106, p. 221) from China to Asia Minor and around the Mediterranean and which has substituted the much diminished resistance of rolling for that of dragging or sliding. We might examine all the ingenious methods that man has discovered for facilitating transportation on men's backs (baskets, etc.), or transportation with the help of animals.[2]

But the unparalleled superiority of the new means of transportation lies, not in their rapidity (the value of which

FIG. 104. PIROGUE OF THE KANAKAS OF NEW CALEDONIA EQUIPPED WITH OUTRIGGER AND SAIL

is appreciated only by means of education), but in the weight—that is, the maximum and total weight — that can be transported per unit. Formerly only precious products, such as incense, gold, and silk, could be transported any great distance.

[1]See also an interesting note on David MacRitchie's *Le Kayak dans l'Europe septentrionale*, by Rabot in *La Géographie*, September 15, 1911, pp. 186–189.

[2]See M. Haltenberger, "Primitive Carriers in Land Transportation," *Bull. Amer. Geog. Soc.*, Vol. XLVII, 1915, pp. 729–745.

Here is a rough comparison which explains the entrance into traffic of so many heavy materials and the unprecedented power of modern means of traffic:

APPROXIMATE EQUIVALENTS OF THE WEIGHTS TRANSPORTABLE BY DIFFERENT MARITIME AND TERRESTRIAL MEANS[1]

A great transatlantic steamer (merchandise transport)	22,050 tons
An ordinary steamer	5,515 to 6,615 tons
A large sailboat	3,307 to 5,515 tons
A Rhine boat	1,102 tons
A wagon for merchandise	11, 13, or 16 tons
An automobile truck	2.7 to 5.5 tons
A horse *draws*	2,205 pounds
An ordinary aëroplane[2] *carries*	300 pounds
An elephant *carries*	882 pounds
A camel *carries*	441 pounds
A horse or a mule *carries*	331 pounds
An ass *carries*	165 to 220 pounds
An eskimo dog *draws*	99 pounds
An ass (in India) *draws*	55 pounds
A sheep or a goat (in the Himalayas) *carries*	26 to 35 pounds
A porter (in Africa or Asia) *carries*	55 to 66 pounds

Of the two transportation animals of early America, the dog of the Eskimos in the extreme north and the llama in South America, the first can *draw* 99 pounds (45 kilograms) and the other *carry* 66 pounds (30 kilograms). At the time of Shackleton's expedition to the Antarctic, the sturdy Manchurian ponies, to which the explorers owed in part the success of their attempt, *drew* from 551 to 661 pounds (250 to 300 kilograms). According to these figures, it takes about 10 horses to *draw* the weight of ten tons carried by a small dray, and 45 camels, 60 horses, 100 asses, or 330 men to *carry* this same weight.

All the general geography of trade and traffic will describe in more or less detail the *surface picture* which results from the

[1] A considerable number of figures in this table are borrowed from Max Eckert, *Grundriss der Handelsgeographie*, I, p. 143.

[2] An ordinary aëroplane carries, in reality, its pilot (165 lb.) (75 kilos.) and fuel enough for several hours of travel, which means 100 lbs. as a minimum. The development of aëroplanes has been so great since 1914 that one cannot really compare their possibilities with other means of transport. In 1919 an aëroplane carrying two men successfully crossed the Atlantic as a feat of endurance. In practical use, however, the radius of service is limited by many conditions. Dirigibles by virtue of being *lighter than air*, are not so strictly limited, and the weight carried depends on the volume; the cubic capacity of some of the destroyed Zeppelins was from 530,000 to 630,000 cubic feet (15,000 to 18,000 cubic meters), and they could carry as much as 6,000 lbs. (3,000 kilos.)—that is, about 40 persons. The British Dirigible B-34, which had a gas capacity of 12,000,000 cubic feet, and which in 1919 made the first round trip from the British Isles to the United States, carried a total load of 68,640 pounds and was 75 hours in the air on its return journey.

Renée de Margerie

FIG. 105. THE MARITIME TRAFFIC ALONG THE COASTS OF NORWAY, IN THE VICINITY OF THE SEVEN SISTERS PEAKS

On the coast of Norway, at the outlets of the fjords,—between the numerous islets which form the Skjoergaard (Skerry Wall) and the heights of the mainland,—extends a sort of long maritime channel, unequal, sinuous, quite narrow in some places, but protected against the tempests of the high sea, which provides a wonderful passage for traffic.

connection of facts on the earth. It will show the zones or points on the surface of the earth which are the chosen places of trade and it will show them as large or small, general or

Vérascope Richard

FIG. 106. AT COLOMBO. THE WHEELED CART OF SOUTHERN ASIA

local, with their characteristic equipment of means and agents of transportation (Figs. 105, 107, 108, pp. 220, 222, 224). It must even see, as it were, in all their reality, phenomena of larger dimensions, the whole of which our eyes cannot actually grasp: the close cluster of maritime commercial lines in the North Atlantic Ocean or the Mediterranean; the points of the earth's crust where all these more or less divergent lines approach to join and mingle, either ending at a great port or passing through a narrow way, such as the Suez Canal, etc.; the world system or local systems of telegraph or telephone wires, the network of submarine cables, etc.[1]

[1]With regard to cables, see especially Th. Lenschau, *Das Weltkabelnetz angewandte Geographie*, I, 1, Halle, 1903; and Maxime de Margerie, *Le Réseau anglais de cables sous-marins*, A. Pedone, Paris, June, 1910. See, too, the *Nomenclature des cables formant le réseau sous-marin du globe*, published by the International Telegraph Bureau at Bern. For the Suez Canal, the success of which has surpassed all expectations, consult the articles in *Rev. de Paris*, October 1, October 15, and November 1, 1899), as well as J. Charles-Roux, *L'Isthme et le canal de Suez, historique, état actuel*, Hachette, Paris, 1901, 2 vols. of more than 500 pages, 268 figures, and 18 plates. For the Panama Canal, see Haskin, *The Panama Canal*, 1914; E. R. Johnson, *The Panama Canal*, 1916.

Jean Brunhes

FIG. 107. A PORT IN THE NORTHERN PART OF THE GREAT PASSAGEWAY OF MARITIME TRAFFIC ALONG THE COAST OF NORWAY: THE PORT OF TROMSÖ

The port of Tromsö, very well sheltered and with its back to the high sea, is quite an important exchange center in the northern part of the long maritime passage referred to in Fig. 105. It is also an outfitting port for the fishermen of the Arctic seas.

From this point of view, how different is the actual physiognomy of the various continents!

Asia [says Hückel[1] in summing up], with its belt of high plateaus, steppes, and deserts, forces the great routes to turn to the north (trans-Siberian railroad)[2] and to the south (Suez Canal, Bagdad railroad). It is less favored than America with its great transcontinental communications (railroads of North America, the Panama Canal).

Africa, a country of plateaus, without peninsulas, obliges trade to follow the great hydrographic systems such as that of the Nile and is but lightly touched by the great lines of ocean commerce. Finally, Australia, an isolated continent, ten days from Singapore and fourteen from Ceylon, is of such character in the interior that its states were long compelled to communicate with each other only by sea and are really bound together — and here not closely — only in the east.

In Europe the trade systems are particularly crowded toward the west. From the strip of central Europe, limited on the north by the Warsaw-Berlin-Cologne-Brussels line and on the south by the Budapest-Vienna-Munich-Paris line, are clearly distinguished the insular and peninsular countries situated north of 55° and south of 45° N. latitude. The paths of trade, which diverge toward the east, approach each other in the west at Hamburg, Antwerp, the ports of France, and Lisbon.[3]

Along with these currents of trade of which the direction is "latitudinal" must be mentioned the oblique currents passing from London to the Mediterranean Sea and especially that very active strip that runs from Paris to Marseilles. It is

[1]Article quoted, *Ann. de géog.*, XV, 1906, p. 406.

[2]Trans-Siberian: the International Company of Sleeping-Cars before 1914 maintained a combined service of sleeping-cars of the first and second class which placed Paris but fourteen days from Japan. From London, from Brussels, or from Paris one could reach Berlin by the Nord-Express; then leaving Berlin on Tuesday, between 7:00 and 8:00 in the morning, arrive at Moscow Wednesday evening, at Omsk Sunday morning, at Irkutsk Tuesday night, and at Vladivostok the following Saturday at 9:25 in the evening (Kharbin time), or at 3 o'clock in the afternoon (Petrograd time).

[3]See J. Partsch, *Mitteleuropa* (Gotha, 1904), pp. 408–410. P. Vidal de la Blache, *Tableau de la géographie de la France* (Paris, 1903, pp. 31–32), shows that the ancient routes of migration and the prehistoric zones of settlement correspond with several avenues which traverse Europe from east to west: first, through the valley of the Danube, ending in Burgundy; second, through the German plain and Belgium, ending in Picardy; third, through the alluvial plains along the shore of the North Sea, as far as Flanders.

Clouzot

FIG. 108. ON THE VENDÉE: THE RETURN FROM HARVESTING IN THE MARSH LANDS (MARAIS)

In the Vendean "Marsh," circulation and transportation are by water

From *The Principal Aspects of the Globe, France, 1912*, M. Allain and H. Hauser

represented on the ground to-day, almost from one end to the other, by four lines which are hardly sufficient to bear the traffic.

It is impossible also not to note the great diverging fan of railroad tracks which has its center in the plain of the Po and the lines of which cross the Alps through the great transalpine tunnels and stretch away to the extremities of Europe — to London in the west and Petrograd in the east. The old attraction of the Mediterranean and of Italy, which is pre-eminently the historical embodiment of the "empire" of the Mediterranean, is shown by this design in steel, one of the most expressive in Europe.

Switzerland has profited from this attraction in large measure, and, but for the concentration of trade brought about by the bow-like form of the Alps and the activity of the Italians of the north, she would doubtless have remained outside the great economic currents instead of being master of their subterranean gates. It seems, however, that a certain movement is taking shape which aims at independence of this concentration of lines in upper Italy and which, while awaiting merchandise, is beginning by turning aside some thousands of travelers.[1]

In 1909 Austria inaugurated the line and tunnel of the Tauern which bring Hamburg, Berlin, and Munich respectively within 801, 1,120, and 323 miles (1,290, 1,804, and 520 kilometers) of Trieste, instead of the 892, 866, and 502 miles (1,436, 1,395, and 808 kilometers) which separate them from Genoa by way of Saint Gotthard. Toward the west a train de luxe was formed, the Riviera Express, which ran from Berlin to Ventimiglia in less than thirty-two hours. This line not only goes around the western curve of the Alps but passes through Mülhausen, Belfort, Besançon, Bourg-en-Bresse, and Lyons, avoiding Swiss territory.

Let us go still farther. All the facts of traffic must be looked at in themselves and for themselves exactly as the facts of installation were considered (Sec. 4, p. 131). They are localized; it is therefore proper, after having defined their typical form

[1] Merchandise is more rigorously faithful to certain lines of circulation and more strictly bound to certain laws of transit, such as the law of the shortest distance in miles.

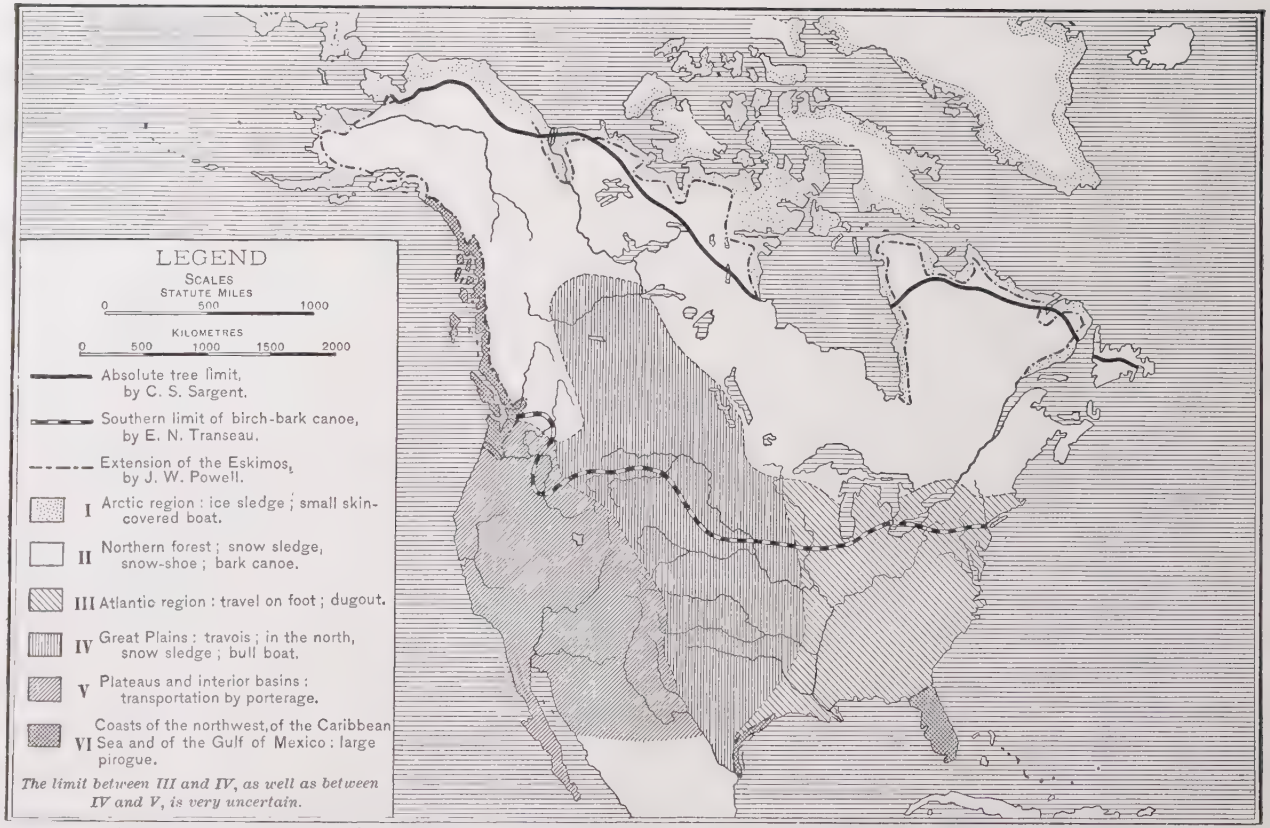

LEGEND
SCALES
STATUTE MILES
0 500 1000
KILOMETRES
0 500 1000 1500 2000
Absolute tree limit, by C. S. Sargent.
Southern limit of birch-bark canoe, by E. N. Transeau.
Extension of the Eskimos, by J. W. Powell.
I Arctic region : ice sledge ; small skin-covered boat.
II Northern forest ; snow sledge, snow-shoe ; bark canoe.
III Atlantic region : travel on foot ; dugout.
IV Great Plains : travois ; in the north, snow sledge ; bull boat.
V Plateaus and interior basins : transportation by porterage.
VI Coasts of the northwest, of the Caribbean Sea and of the Gulf of Mexico : large pirogue.
The limit between III and IV, as well as between IV and V, is very uncertain.

FIG. 109. GEOGRAPHIC DISTRIBUTION OF THE MEANS OF TRANSPORTATION AND CIRCULATION AMONG THE ABORIGINES OF NORTH AMERICA, BY H. BAULIG

and appearance, to seek to determine: (1) their site (zone of extension); (2) their dissemination or concentration; and especially (3) their limits.

The systems of inland paths of navigation and the railroad systems, whether in each country or in the world as a whole, present themselves to us with zones of maximum density[1] and with limits. It will always be one of the real concerns of geography to determine these maxima of density and to fix these limits: limits in *latitude* (examples for railroads: the most northern line in the world is the Scandinavian line which runs from Gellivara to Narvik and to the Ofoten Fjord and which reaches 68° 27′ N. latitude; the most southern system is that of New Zealand) and limits in *altitude*. For maximum altitudes in South America, see the figures given apropos of the large cities of the world above 4,900 feet (1,500 meters), pp. 188–195; maximum altitudes of the cog railways in use in Switzerland: the terminal station of the Gorner Grat, 9,902 feet (3,018 meters); the Eismeer station, which is only a temporary terminus of the Jungfrau Railroad, 10,371 feet (3,161 meters); higher altitudes of North American railroads: the Denver & Rio Grande Railroad, 11,329 feet (3,453 meters); the Pikes Peak Railroad, 13,976 feet (4,260 meters); the Moffat Road, 11,660 feet (3,554 meters).

From the local point of view, as far as the method to be followed is concerned, we know of no better model than the article by H. Baulig, "Sur la distribution des moyens de transport et de circulation chez les indigènes de l'Amérique du Nord," an article that is all the more remarkable because it is

[1]The calculation of what is called the density of a railroad system is delicate and susceptible of various critical interpretations; see *Geog. Zeitschr.*, VI, 1900, pp. 220–223, 395–396, and 635–639. At the end of 1909, Europe with its 146,000 miles (235,000 kilometers) of railroad, North America with its 300,000 miles (485,000 kilometers) and Asia with its 48,500 miles (78,000 kilometers) represented respectively 35 per cent, 50 per cent, and 8 per cent of the total of the railroads of the world. But these absolute values are insufficient to represent the *human* value of these means of communication. The United States, for example, have built 228,528 miles (368,000 kilometers), but this makes only an average of about 241 miles (389 kilometers) for a surface of 3,861 square miles (10,000 square kilometers); for a similar surface of 3,861 square miles (10,000 square kilometers), see the length of railroads constructed in some typical states (according to the *Geog. Statistische Tabellen* by v. Juraschek):

United States	242	miles	390	kilometers
France	460	"	740	"
Germany	670	"	1,080	"
United Kingdom	732	"	1,180	"
Switzerland	739	"	1,190	"
Belgium	1,577	"	2,540	"

primarily the explanation of, and a commentary for, a map[1] (Fig. 109, page 226).

Let us conclude with a reflection of more general import and one which may serve as the real bond between this chapter and those to follow. Traffic or circulation is brought about by all the characteristic forms of destructive economy and the necessary migrations which result from them (see chapters IV and V), and, above all, by trade. Trade tends to bring raw materials or manufactured products to those places where there is a demand for them or where they are useful. Moreover, physiological appetites and needs of food among men are not all; there is something more than the stomach; human society has other needs; there is notably the need of labor which has been the explanation of so many transplantings of human beings (see chapter IV). How many currents of continuous immigration or how much of the ebb and flow of periodic migrations are determined and directed by calls for labor! From this point of view, the demands, repeated each year, which bring down the mountaineers of the Ligurian Appenines to the rice fields of Novara or Vercelli are the equivalent of those indispensable demands for Italian labor which arise whenever a great transalpine tunnel is to be dug, or again of those more or less lasting transplantings under the influence of intermittent industrial exploitations of which German brickyards furnish a typical example. The brick industry (which to-day tends to become a permanent industry) remained for a long time, and is still in large part, a matter of season, and it is migrating workmen who furnish the necessary labor: before 1914 Russians and Poles had penetrated to the brickyards of the Weser and of the Elbe; Czechs had invaded the brickyards of Saxony; Walloons and Dutch worked in those of the Rhinelands and Westphalia; and Italians came naturally to offer themselves to the brickmakers of southern Germany.[2]

[1] *Ann. de géog.*, XVII, 1908, pp. 433–459, a study based principally on the documents published by O. T. Mason in the various collections of the Smithsonian Institute. The map reproduced here is from the map by H. Baulig, published in the *Annales*, p. 435.

[2] See Bruno Heinemann, *Die wirtschaftliche und sociale Entwickelung der deutschen Ziegelindustrie unter dem Einflusse der Technik*, Werner Klinckhardt, Leipzig, 1909; and by the same author, "La Briqueterie allemande," *Rev. écon. internat.*, April 15–20, 1910, pp. 116–131.

As a synthetic expression of all these needs and as a resultant of all their first experiences in exploiting and exchange, men learn to conquer space—free space and, especially, space populated by human beings — and they acquire more and more the spirit of conquest. In this sense circulation, or the movement of trade, becomes the conqueror of space. No true power results from space alone, from naked space. Space has value only through its connections with life.

CHAPTER IV

THE ESSENTIAL FACTS OF HUMAN GEOGRAPHY
(*Continued*)

SECOND GROUP: FACTS OF PLANT AND ANIMAL CONQUEST. CULTIVATION OF PLANTS AND RAISING OF ANIMALS[1]

1. *The geography of plants and animals in their relations to the important facts of climate.*
2. *Origin, importance, and number of cultivated plants and domesticated animals.*
3. *The principal cereals chosen as types of cultivated plants: wheat, rye, barley, oats, maize, and rice.*
4. *Other types of plant production.*
5. *Plant and animal types of textile products: cotton, silk, and wool.*
6. *Pastoral nomadism: typical forms; varied forms; weakened forms; semi-nomadism.*

1. THE GEOGRAPHY OF PLANTS AND ANIMALS IN THEIR RELATIONS TO THE IMPORTANT FACTS OF CLIMATE

From the geographical point of view, the geography of plants is still more significant than the geography of animals. Plants do not move; they are fixed in the ground and therefore cannot avoid certain extremes of temperature or of insolation which animals can easily escape by a change of place. Further, plants are really the fundamental part of human food. The animals upon which man feeds live upon plants or upon other animals which are herbivorous. The distribution of

[1]References: A. R. Wallace, *The Geographical Distribution of Animals*, 2 vols., London, 1876; Angelo Heilprin, *The Geographical and Geological Distribution of Animals*, London, 1887; W. L. and P. L. Sclater, *The Geography of Mammals*, London, 1899; E. Warming (English adaptation by Percy Groom and J. B. Balfour), *Oecology of Plants*, Oxford, 1909; F. E. Clements, *Plant Physiology and Ecology*, New York, 1907; M. E. Hardy, *An Introduction to Plant Geography*, Oxford, 1913; M. I. Newbigin, *Animal Geography*, Oxford, 1913; V. C. Finch and O. E. Baker, *Geography of the World's Agriculture*, U. S. Department of Agriculture, Washington, D. C., 1917.

cultivation therefore lends itself to geographical analysis to a degree much more striking than the distribution of domestic animals.

For this reason, while not ignoring the subject of animal conquest, we shall deal more particularly with that of plants.

Plants form organic groups which reflect the strong influence of the environment in which they live. The earlier classifications of botanical geography gave too much importance to climate alone and to certain particular factors of climate. This notion has given place to a much truer and more exact idea—the idea of environment. We must take into consideration the entire environment—climate, soil, and, finally, the living beings and the other plants beside which and among which a certain plant is obliged to develop. Certain plants live together in groups, even while belonging to different species; they join together because they happen to be adapted, in a somewhat similar manner, to the general conditions of that part of the earth in which they grow.

A plant is in itself a complex. It is composed of different organs which endure in a different manner a given phenomenon of temperature, and each of the reproductive or vegetative organs of the plant has an annual evolution which causes it to feel differently the effects of the succession of the seasons. The ideal for a plant will be the climate, the soil, and the biological environment which will correspond each moment to the progressive demands of its organization and its life; thus is formed the idea of *biological optimum*. Theoretical analysis cannot tell us *a priori* how a plant will act with reference to a given soil.

Certain soils are rich in salts which the plant requires, but these salts occur in an insoluble or unassimilable form and the plant then finds itself in the same condition as if these salts did not exist. Inversely, some plants (halophilous, calciphilous, and others) seem to seek soils rich in mineral elements (sodium chloride, carbonate of lime, etc.). They simply have an organization which enables them to endure these salts in quantities that to other species would be injurious or even fatal.

The learned Belgian specialist in agronomy, A. Proost,

has demonstrated theoretically and by many experiments the value of what he calls the "analysis of the soil by the plant."[1]

Regions of the earth may be rich in precipitation, as New Zealand or certain islands on the coast of Brittany or Friesland; yet the strong, continuous winds may cause such evaporation that the plants, though receiving more than 6 or 10 feet (2 or 3 meters) of water per year, are compelled to protect themselves against evaporation exactly as in a desert region.

A phenomenon of the same order is sometimes found magnified in a still more typical fashion when we reach the regions of the far North. For example, on the western coast of Greenland, plants have been found which protect themselves from evaporation by the same processes and often with the same outward behavior as certain plants in the middle of the Sahara.[2]

In western Europe precipitation takes place during the winter season, but in a form and at a temperature such that the plant cannot profit by it; and that is why the organs of respiration and transpiration disappear: the trees lose their leaves. In other words the plants adapted during a part of the year to a damp climate (plants called *hydrophytes*) become during the remainder of the year practically different plants and as if suited to a dry climate (such plants being called *xerophytes*); and such *changing* plants are known as *tropophytes*.

Finally, soil has no value for plants except in connection with climate, and, inversely, climate only in connection with

[1] "In a blackish, earthy alluvium, along the banks of the Dyle at Ottignies-Mousty, there is, in places, a profusion of plants containing potassium, although this alluvium is in itself very poor in potassium. This anomaly is explained by certain mixtures of glauconiferous sands, the green or black grains of which contain, as we know, some soluble potassium in the form of carbonate. In the same way, feldspar and mica also yield a certain amount of potassium, which is not revealed by the usual laboratory analyses" (*Carte agricole de la Belgique, Procès-verbaux des réunions consultatives*, Brussels, 1901, p. 33). On the subject of plants as showing the composition of the soil, see E. W. Hilgard, *Soils, Their Formation, Properties, Composition, and Relations to Climate and Plant Growth in the Humid and Arid Regions*, Macmillan, New York, 1906, as well as the article devoted to this book by A. Woeikof in *Ann. de géog.*, XVI, 1907; read especially pp. 386 and 398.

[2] The soil of the Arctic regions, because of the prevailing low temperatures which do not allow absorption of moisture by plants, ought really to be considered as being almost always *physiologically* dry. On this subject see M. Rikli, *Die Pflanzenwelt des hohen Nordens in ihren Beziehungen zu Klima und Bodenbeschaffenheit*, St. Gallen, 1903.

soil.[1] Certain limestones exclude certain families of plants in damp regions, while the same limestones are very favorable to these same plants in regions such as that about the Mediterranean. There rain is rarer in spring and summer and occurs only in the form of passing showers; the quantity of carbonate of lime which is thus placed at the disposition of the plant is not likely to be so abundant as to stifle it, something which occurs normally in limestone regions watered by fine and continuous rains.

All these phenomena show us how insufficient is analysis alone to enable us to understand the conditions of life on the earth as a whole. We must consider the entire group of natural conditions in the many delicate and almost imperceptible connections existing between these different factors which form the environment. One can easily see then that the plant should be considered as a sort of telltale mark of these groups of conditions.

Since we thus arrive at the fundamental notion of environment, we cannot insist too strongly upon the importance of

[1]This is so emphatically true that, at the first Agrogeological Conference of Budapest in 1909 (the second was held in 1910 at Stockholm), the compilation of a "soil map of Europe on a climatic basis" was discussed. In summarizing the chief points of a report on this subject made by Treitz at Budapest, Th. Bieler-Chatelan communicated to the Society of Natural Sciences of the canton of Vaud the following curious and typical observations: "In the plain of the Rhone, above Martigny (Valais), it is an established fact that in several places, especially at Saxon, Ecône, Sion, and Granges, the soil during the dry season becomes covered with *saline efflorescences*. These salts, whether sulphate of sodium (as at Ecône) or sulphate of magnesium (as at Saxon), form sometimes quite extensive beds, very harmful to vegetation, especially when they produce at the surface of the soil a *crust* capable, so to speak, of *strangling* young plants. This formation seems at first sight surprising in a region where the annual rainfall (600 mm., 23.68 inches), although the lowest in Switzerland, yet considerably surpasses that of regions with an arid continental climate. It would be truly surprising if the air remained motionless; but this is not the case. In the valley of the Rhone there is a constant wind that accelerates the evaporation of the soil and thus causes the saline solution to rise to the surface, where it is concentrated and forms a crust of considerable hardness as it dries. We have found proof of this in measuring the salinity of the soil at different depths, at the School of Agriculture at Ecône (near Riddes), where the beds are formed of sulphate of sodium:

DEPTH	SALINITY
Crust at the surface	42.0 per cent
" at 3.9 inches	4.6 per cent
" at 7.8 inches	.9 per cent
" at 11.8 inches	.5 per cent

"There is, then, a very distinct progressive increase in salinity from the depth toward the surface" (minutes of the session of April 20, 1910, Société vaudoise des sciences naturelles). So, a short distance from the high snow peaks and the glaciers of the Swiss Alps, at the bottom of that depression in Valais, certain local climatic conditions, when the valley is overheated and dry, produce saline efflorescences similar in every way to those which appear in desert territories. See Brunhes, *L'Irrigation*, p. 235, Fig. 22, and p. 325, Fig. 44.

the human environment, its density, and its quality from the point of view of cultivation. Cultivated plants depend upon the number of men, upon the strength and fitness of human muscles, as much as upon the climate and the soil. These factors have been too often neglected, not only in strictly agronomic studies, but also in economic studies. One of the purposes of human geography is to make clear this factor of labor.

The geography of cultivated plants and domestic animals is then directly connected with the general geography of climates, and in order to localize either it is indispensable to distinguish on the earth's surface the chief climatic zones. By reference to these zones we shall be able, in the following pages, to indicate clearly to what sections certain plants and animals belong.

Among the natural classifications of the climates of the earth there is one in particular which imposes itself upon us—that of Köppen. Climate being above all a very complex fact, we run the risk, if we consider separately temperature, pressure, or rainfall, of failing to understand the synthetic reality which is the result of the combination and reciprocal reactions of these different factors. The plant, on the contrary, which forms a part of the natural vegetation of a region, being obliged to undergo the complex and combined effects of all the factors of climate, constitutes a recording apparatus which can show to a remarkable extent, if it be well chosen, the cumulative effects of the different climatic phenomena. Such a classification based upon facts of vegetation will be all the more valuable for us as we proceed to consider in what natural regions can live and develop (1) plants which are cultivated and (2) animals living upon plants.

Flahault[1] has simplified the work of Köppen.[2] We take the liberty, for our present purpose, of restricting the number of natural provinces and of reducing the general table to a few simple and fundamental features which may serve us as guides

[1] See Ch. Flahault, "Le Progrès de la géographie botanique depuis 1884, son état actuel, ses problèmes," *Progressus rei botanicae*, I, 1906, pp. 276–284.

[2] See W. P. Köppen, "Versuch einer Klassifikation der Klimate, vorzugsweise nach ihren Beziehungen zur Pflanzenwelt," *Geog. Zeitschr.*, VI, 1900, pp. 593–611, 657–679, and Plates 6 and 7.

for the studies to follow. We give here first of all this simplified classification as a whole:

CLIMATES OF THE EARTH

Simplified Synthetic Table, according to Köppen and Flahault[1]

A. Megathermal (warm and humid):
   1. Climate of the lianas
   2. Climate of the tropical savannas

B. Xerophilous (dry):
   1. Climate of the date palm
   2. Climate of the saxaul
   3. Climate of the herbaceous steppes

C. Mesothermal (middle zones):
   1. Climate of the olive tree
   2. Climate of the maize
   3. Climate of the camelia
   4. Climate of the high savannas

D. Microthermal (moderate cold):
   1. Climate of the deciduous oak
   2. Climate of the birch

E. Hekistothermal (cold):
   1. Climate of the white fox (arctic tundras)
   2. Climate of the penguin (antarctic tundras)
   3. Climate of the yak (Tibet)
   4. Climate of the chamois (Alps)

A brief commentary will suffice to outline the characteristics of each of these provinces of the earth.

A. Megathermal Climates

Megathermal climates are the warm and damp climates of the equatorial regions, or regions which have similar characteristics, like those which are watered by the heavier summer rains of the monsoons.

Among these climates we distinguish two main groups of natural provinces:

1. The first is that of typical equatorial regions (*climate of the lianas* with no dry seasons and more than 75 inches of annual rainfall). The forests are very tall, always green, and full of

[1]Some time before Köppen, A. de Candolle, Grisebach, Woeikof, and Drude popularized the ideas of megathermal, xerophilous, and microthermal climates, etc.

vines and epiphytic plants;[1] this is particularly the region of the great palms, which, excepting the date palm, nearly all belong to hot and damp regions.

2. The other group is that of the bordering zones of the equatorial region. North and south of the equator the rains decrease both in intensity and in duration; they become seasonal rains depending upon the zenithal position of the sun. Here, then, occurs a dry period of longer or shorter duration, increasing in length the farther we go from the equatorial region. The large forests are less dense and they tend to break up; groups of trees only occasionally appear in the midst of wide stretches of grass; finally the grass covers the entire ground. This is the zone of the tropical savannas, dominated very often in Africa by that magnificent and characteristic tree, the baobab. To this zone corresponds the large, fertile, and dense transitional region which is situated, in central Africa, between the Congo Forest and the Sahara and forms the Sudan.

B. Xerophilous Climates

Xerophilous climates are those which impose on vegetation a special adaptation to dryness: deserts and steppes covered by thorny bushes and a series of plants with long, penetrating roots which spread in clusters. This zone of xerophilous climates forms everywhere a barrier to the intensive development of human life and economic activity. The only points where man can make permanent settlements are in the oases where water is available.

Among the xerophilous climates Köppen distinguishes a first province under the name of *climate of the date tree.* Here the fact of cultivation serves to express the general conditions of the climate. The date palm cannot endure cold.[2] It belongs to regions of which the mean annual temperature is above 20° C. (68° F.); it disappears as soon as the desert is

[1]Good clear descriptions of the various types of vegetation, descriptions which include physiological, physiognomical, and geographical viewpoints, may be found in Edmond Gain, "Introduction à l'étude des régions florales, Notions de géographie botanique," Parts I and II, *Bulletin de l'Institut colonial de Nancy,* Crépin-Leblond, Nancy, 1908, See I, pp. 60 ff.

[2]See Brunhes, *L'Irrigation,* etc., p. 241, and consult the monograph by Theobald Fischer, "Die Dattelpalme, ihre geographische Verbreitung und kulturhistorische Bedeutung," *Petermanns Mitt., Ergänzungsheft,* No. 64, 1881.

subject to a cold season. The great regions of the date palm, such as the Sahara and Arabia, are the natural habitat of running animals—the ostrich, the camel, the horse.

Beside these warm deserts we must place, because of similarity and contrast, the cold deserts—that is, the deserts with a severe winter.[1] Deserts with a cold winter occupy depressions such as that occupied by the Transcaspian desert. There an indigenous shrub, the saxaul, has developed, and has helped in the conquest of the desert by holding the dunes in place.

Between the hot and the cold deserts and on their borders we meet with a whole series of transitions which correspond to different steppes, more or less dry or damp. In particular, the deserts with a cold winter are bordered on the north by zones where condensation causes summer rains. Vegetative activity here often undergoes winter and summer interruptions. Nevertheless the vegetation appears in the form of a continuous carpet. This is the great zone of the prairie steppes which extends from Mongolia into central Europe and which has played so large a part in the history of the Old World. This same zone is represented by the western prairies of North America.

C. Mesothermal Climates

As we approach the middle zones corresponding to the mesothermal climates, the combinations of shades of difference are more manifold and these shades of difference are themselves more varied. That is, the natural provinces are more and more numerous and of less extent.

We shall select from these mesothermal climates only the types of greatest interest from the point of view of human geography. The *climate of the olive tree* is above all the climate of the European Mediterranean, with mild and damp winters and winter rains which, according to conditions, are more vernal or more autumnal and which precede or follow dry summers. Here are found trees and shrubs which are always

[1] Deserts with a rigorous winter, but with a summer always hot and dry. Do not confuse this type of desert, always partially warm, with deserts where the soil is always frozen. See, below, the hekistothermal climates, and see farther on the two principal types of desert which are distinguished, both in the text, p. 243, and on the map, Fig. 111, pp. 244–245.

green and that bushy vegetation of which we have already had occasion to speak in the chapter on the house.

The *climate of the maize* represents the transition between the *prairie steppes* and the region characterized by the olive tree. The winter is not severe, the spring and early summer are damp, the summer and the autumn are dry. It is the rainfall and sunlight of the early growing season which favor the cultivation of maize. This type is met with in northern Italy, in Roumania, and in the United States.

The *climate of the camelia* corresponds to a better watered summer, to a continuation of the rains into the middle of summer. This is the climate of southern China, of the eastern end of the Black Sea, of the lake region of northern Italy, and of the plains of Uruguay and Paraguay; this zone is important because in Asia it represents the principal zone of tea.

These last types of climate, belonging to regions that are inclined, so to speak, to a higher altitude, are characterized by heavy summer showers, following rather dry winters and springs. This determines the vegetation of the high savannas of Mexico or Abyssinia.

D. Microthermal Climates

With the microthermal climates we reach the zone which we have already described as forming the boreal forest. They are cool temperate climates with snow in winter and rain in summer. In this region Köppen rightly distinguishes a more southern province which he calls that of the *deciduous oaks*, and a colder and more northern province which he calls the *climate of the birch*.

In the first we find four months at least with a mean temperature above 10° C. (50° F.). In the second the summer is shorter and the winter more severe; the vegetation is that of great forests with rigid trunks and of pure growth. These are the special regions of the great cereals of the temperate zones—wheat, rye, barley, oats—and also of the potato.

E. Hekistothermal Climates

Extreme or hekistothermal climates correspond to zones where even the warmest month has a mean temperature below

10° C. (50° F.). Here trees disappear after having assumed slender and dwarfed forms in the transitional zone between this and the region of the preceding climates. The plants are bound only to local conditions of humidity or orientation, and Köppen rightly prefers to distinguish the provinces of these extreme climates by taking the animals as expressive types of the climatic facts. He distinguishes the Arctic tundra and calls its climate the *climate of the white fox;* the sub-Antarctic tundra, which corresponds to the region of the penguin; the region of the Pamir and of Tibet, which corresponds to that of the yak, and, finally, the climate of the upper zone of the Alpine mountains inhabited by the chamois. These animals are the last companions of man and one may say that, thanks to some of these representatives of animal life of exceptional resistance (yak),[1] the inhabited region extends beyond the limits of the microthermal climates. It should be noted that the climate of the white fox is also the climate of the reindeer. It is true that the reindeer is often found south of the limit of the tundra and that it does not go as far north as the white fox;[2] but cannot the same thing be said of the yak, which comes south into the valleys of Kashmir and is not found as high or as far over Tibet as such a wild herbivorous animal as the hemione or kiang?

The Great Climatic Emblems of the Earth: Three Homogeneous Vegetational Formations and Two Types of Deserts

When the world as a whole is taken under consideration, there are great, striking facts which are inscribed on the ground with clearness and exactitude by the vegetational covering. Accepting the preceding classification as a basis, let us examine more clearly the general divisions in which Köppen's different regions are placed.

Although humidity is an important factor, yet it is temperature which furnishes the basis for every climatic division of the earth. Like Köppen, let us adopt the temperatures of 10° C. and 20° C. (50° and 68° F.) as characteristic averages. We

[1] Ratzel has frequently, and rightly, emphasized the *Randvölker*, or marginal peoples, living at the extreme limit of the inhabited world.

[2] On the subject of the southern limit of the reindeer in Norway and Sweden, see Charles Rabot, *Aux Fjords de Norvège et aux forêts de Suède*, Hachette, Paris, 1905, p. 190.

then distinguish on the earth "geothermic zones" whose boundaries are modified and complicated upon contact with continental surfaces (Fig. 110).

Let us introduce into the traditional division the factor of

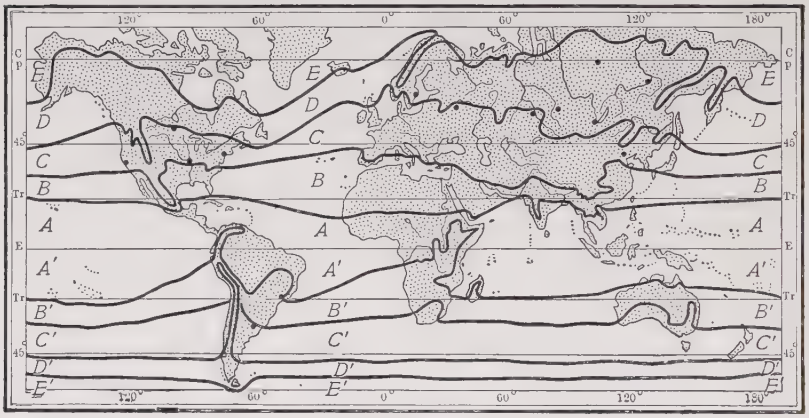


FIG. 110. GEOTHERMIC ZONES

AA,' Equatorial zones with a mean temperature for all the year of more than 20° C. (68° F.)

BB', Subtropical zones, with a mean temperature during 4 to 11 months of more than 20° C. (68° F.)

CC', Intermediate zones, with a mean temperature during 1 to 3 months of more than 20° C. (68° F.)

DD', Cold zones, with a mean temperature during 1 to 4 months of more than 10° C. (50° F.)

EE', Frigid zones, with a mean temperature for all the year of less than 10° C. (50° F.)

In this map are given, along broad lines, the geothermic zones as determined by Köppen, simplified and drawn by Emile Chaix; the illustration is loaned by the author and is taken from his *Notes d'analyse géographique: Conditions qui déterminent la valeur économique d'un pays*, Emile Chaix, Geneva, 1906.

humidity, and it will at once take on a general appearance that brings it near to the reality.

The torrid zone will be divided into hot and damp zones and hot and dry zones succeeding each other and in contrast with each other. Between these two very dissimilar types are the transitional zones, the essential zones from the human point of view.

In the same way the cold zones of the north and south break up into damp cold zones and dry cold zones. Cold and damp zones have a precipitation which is abundant enough to allow the development of forests and for four months at least have a mean temperature above 10° C. (50° F.), thus allowing

vegetative activity: Cold and dry zones in the far north are those where precipitation is rare and insufficient, as in the Alaskan, Russian, and Siberian tundra and in all regions where the temperature always remains so low that no absorption of moisture by plants and therefore no vegetative activity of shrubs or trees is possible. These are often called regions of great physiologic dryness.

Finally, between the cold zones of the north and the warm equatorial or tropical zones are placed all those transitional zones which correspond to the much too vague earlier name of *temperate zones* and more exactly to Köppen's series of *mesothermal climates.*

Now these transitional zones are preëminently human zones, or at least zones favorable to man's development. The following outline shows the succession of the several zones:

Cold zones { cold and dry / cold and damp

A great series of *transitional zones* in the northern hemisphere, called temperate zones (Mediterranean, Atlantic zones, etc.).

Warm zones { warm and dry / *transitional zone* / warm and damp / *transitional zone* / warm and dry

Transitional zones of the southern hemisphere, equivalent to the Mediterranean zones of the northern hemisphere.

Cold zones { cold and damp / cold and dry

Because of its continental dimensions and the almost equal balance of its great mass on each side of the equator, the old continent of Africa shows a distribution of climates which is the nearest approach to what would be the schematic distribution for an earth whose equatorial regions were entirely occupied by continents.

To what natural provinces, then, of the continent Europe-Africa does our theoretical distribution of the zones of climate in the preceding outline correspond? It is evident that we

can place opposite each line of the outline the name of an actual region which will express typically one or several of the characteristic forms not only of the plant life but also of the animal and human life.

Cold zones
- cold and dry..... Lapland
- cold and damp.... Scandinavian and Russian forest

Great series in the northern hemisphere of the *transitional zones* called temperate zones — Atlantic Europe, Mediterranean region, etc.

Warm zones
- warm and dry .... Sahara
- *transitional zone*... Sudan
- warm and damp... Congo Forest
- *transitional zone*... Upper Zambezi
- warm and dry..... Kalahari

Equivalent in the southern hemisphere of the *transitional zones* of the northern hemisphere — Cape Coast

Cold zones
- cold and damp.. Ocean
- cold and dry.... Ocean

Are not all the transitional zones the centers of the maxima of human activity for this continent, Europe-Africa?

From the point of view of its climate, Asia undergoes important modifications as a result of the intense heating in summer of the atmospheric masses in the region of Tibet, of the attracting action of the center of depression there from April to September, and of those great inflowing air currents, the summer monsoons. It may be said that in general the entire succession of the different zones in Africa is here "pushed up" toward the north—from the zone of warm rains to the zone of deserts which thus become cold deserts.

America likewise presents a distribution of climatic zones which is modified in comparison with that of Europe-Africa. The lines of relief in America run in general north and south, and the climatic zones, instead of being vaguely parallel to the equator, have rather an oblique direction with reference both to the parallels and to the meridians.

There are thus unlimited varieties and variations which

deserve the most minute attention in every regional study, but which should not blind us to the following general and essential geographic truths:

Two types of forests: (1) the *equatorial forest* corresponding to the warm and damp zone (Köppen's *climate of the lianas*) and (2) the *boreal forest* corresponding to the cold and damp zone (*microthermal climates*).

Two types of deserts: (1) the *hot or cold deserts* comprised between 50° N. latitude and 45° S. latitude on each side of the equator (deserts in which the summer months are always hot) and (2) the *perpetually frozen deserts* which are those of the tundra and of the permanent snows.

Finally, on the very edge of the deserts of the first class, there are more or less dry or damp steppes with a definitely marked winter and a hot summer, covered over vast extents by types of vegetation of which the grasses, the bushes, or the low shrubs are themselves more or less adapted to dryness or humidity.[1]

Such are the five most general and most apparent *climatic units* of the earth, in the sense that they are found on all continents and that they are preëminently the types that show the strongest contrast with each other.

Since we are here taking the point of view of human activity on the earth, we have represented on a map (see Fig. 111) the locations of these two types of deserts and of these three clearly distinguished and relatively simple typical forms of vegetation.

Now it seems as if these five zones are related through a common feature—the fact that they are for different reasons

[1]It should be said that classifying grass-covered steppes with dry steppes and, on the other hand, separating dry steppes from deserts is a plan based on the precise observations of E. F. Gautier, the explorer of the Sahara. See for example his letter of 1905, addressed to the Geographical Society of Paris: "Some 400 miles from Gao," he says, "we entered a steppe which holds sway without interruption as far as the Niger. This steppe no longer has thorny plants, like those of the Sahara, but a fine grass in a forest of mimosas, continuous though scattered. This wide band of steppes is probably almost continuous from the Atlantic to Egypt, and forms the transition between the true desert and the Sudan—an important and new feature of African geography" (*La Géographie*, XII, October 15, 1905, p. 263). In many other works of his, Gautier returns often to the idea (and Chudeau also) that the Sahara is not so wide as people think it is (*La Géographie*, XIII, January 15, 1906, p. 16). Finally, see E. F. Gautier and R. Chudeau, *Missions au Sahara*, Paris, 1908. Through fear of systematizing too far this general conception of the five great climatic types of the earth, the map in Fig. 111 is based for the most part on the map of the zones of vegetation in Bartholomew's *Atlas*.

1. Equatorial forests. 2. Boreal for
4. Cold deserts (where the ground is alw

FIG. III. THE GREAT C

There are on the earth great natural regions, relatively homogeneous a
most clearly the distribution of climatic effects on the earth. Two types of f

scale = 1:160,000,000

3. Hot deserts (with at least very hot summers).

zo n to a considerable depth). 5. Arid or grassy steppes.

Emblems of the Earth

ast extent. They are the predominating surface phenomena which indicate
and 2): two types of deserts (3 and 4), and immense stretches of steppes (5).

and to varying and modifiable extents distinctly unfavorable to human occupation; they nowhere have a great density of population.[1] On the other hand, let us represent on another map (Fig. 112) the zones which with good reason can be grouped under the title of zones of transition, expressed by more complex types of vegetation: countries with tropical summer rains, such as India, China, or the Sudan; countries with winter rains, such as the shores of the Mediterranean, South Africa, southeastern Australia, or California; eastern sections of the United States where the violent seasonal climatic contrasts of the northern or central plains of North America diminish; countries with a mild and damp climate without great extremes of temperature, such as all that part of Europe which benefits from the influence of the Atlantic, etc. These are populous countries, countries with a vigorous civilization, what we may call in short the home lands of humanity.

A comparison between these maps of zones of vegetation and the map of the distribution of population (Fig. 14) will allow us to check the correspondence which has just been pointed out and to verify the exactness of this general outline into which it is now permissible and useful to introduce all sorts of shades. Let us have recourse to Köppen's classification and, among the transitional zones, let us distinguish the main provinces which he has defined and of which he has marked the limits, especially that of the climate of the olive

[1]Here we clearly distinguish between the question of the actual distribution of the masses of population, taken as a whole, and all the problems which suggest themselves on the subject of the development and of the progress of the various civilizations. It is certain that, from this point of view, the steppes have permitted an easier change of place for human groups, and that the zones of steppes bordering on the forest have been especially sought out; see Robert Gradmann, "Beziehungen zwischen Pflanzengeographie und Siedlungsgeschichte," *Geog. Zeitschr.*, XII, 1906, pp. 305–325; the long introduction by Vidal de la Blache, *Tableau de la géographie de la France*, and in *Petermanns Mitt.* of March, 1910. R. Scharfetter, "Pflanzen und Völkergrenzen," pp. 121–123. Man makes variety on the earth, while the zones most homogeneous in aspect are those in which he plays the least part; see A. Hettner, "Die wirtschaftlichen Typen der Ansiedelungen," *Geog. Zeitschr.*, VIII, pp. 92–100. Ratzel has often insisted in his *Anthropogeographie* on the rôle of the forest as an obstacle to human dispersion, and thus it is not necessary to speak of it here. It would be necessary to speak of it here only in order to emphasize those very correct views; see, for example, what will be said of the Congo forest and of the Fang in chap. V, sec. 2. In the other continent one might choose as an example the Amazon forest, and this is what one would discover: this *selva* is, especially on the border of the water courses, a tangled and disordered confusion, very rebellious and almost impenetrable; indeed, it is only the water courses that can serve as routes for traversing it. The contrast between the two examples given is easily understood.

tree, of the climate of maize, and of the climate of the camelia or of tea.[1] (Once more compare the data of the four maps, Figs. 14, 15, 111, and 112.[2])

2. ORIGIN, IMPORTANCE, AND NUMBER OF CULTIVATED PLANTS AND DOMESTICATED ANIMALS

"The origin," said Humboldt in 1807 in his essay on the geography of plants, "the first home of those plants that are the most useful to man and have been his companions since the remotest ages, is a secret as impenetrable as the original dwelling of all the domestic animals."[3]

To-day we are better informed, particularly through the remarkable book by A. de Candolle, *L'Origine des plantes cultivées*, though there are still plants of the greatest importance, such as wheat or the common bean, about whose primitive home we can make no exact and definite statement.

These facts go back so far that they belong to the history of man's earliest efforts to win from the earth the satisfaction of his needs. There are points on the globe where the furrows newly traced every year on the same plot of ground and in the same direction have perhaps been thus traced from a time that antedates historical documents. Most of the more important sorts of cultivation are older than the first Egyptian or Chinese dynasties.

That ancient power of selection and domestication, which is surely one of the rare gifts of human ingenuity, seems to have been exhausted. In spite of the great progress in scientific methods, the list of new cultivated plants is strikingly meager. If we ask what sorts of cultivation have been introduced in the last two thousand years, we find some new artificial fodders, a few plants with an aromatic berry such as

[1] Maps 111 and 112 have been made on too small a scale. They express an idea and that is all. Maps on a larger scale would show the data with more exactness.

[2] The great work, *Vegetationsbilder*, by G. Karsten and H. Schenk, consisting of a fine collection of photo-engravings published in separate brochures (Gustave Fischer, Jena), furnishes valuable material for the illustration of all the climatic types of vegetation.

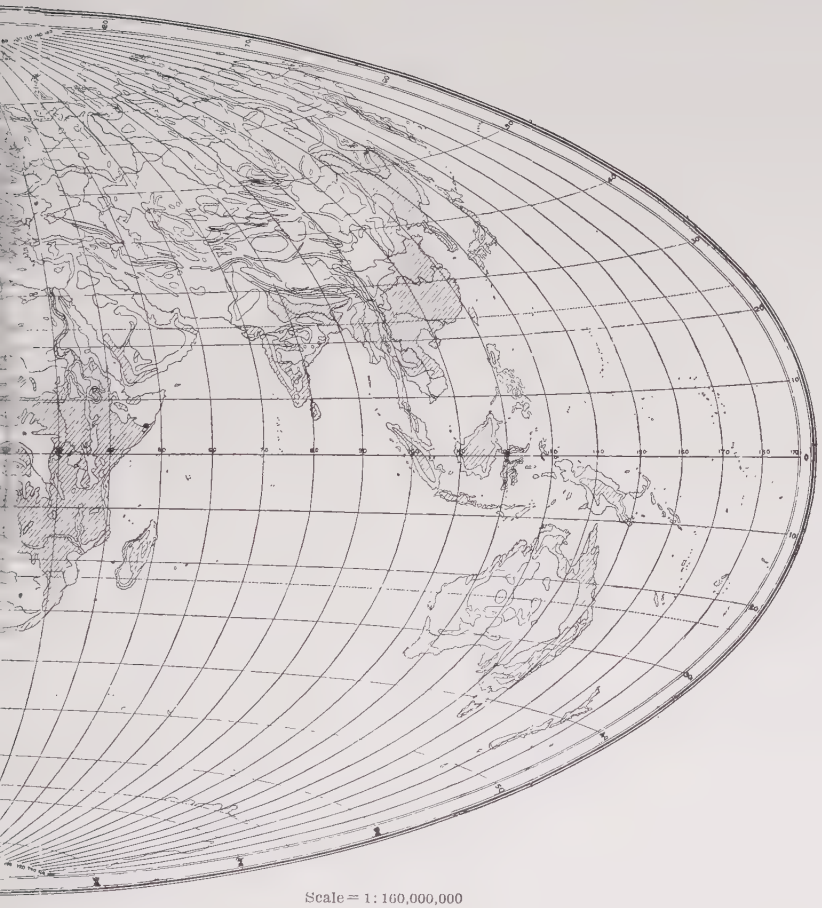
[3] Quoted by A. de Candolle, *L'Origine des plantes cultivées*, second edition, F. Alcan, Paris, 1896, p. 36. See also the following: Victor Helin, *Kulturpflanzen und Haustiere in ihrem Ubergang aus Asien und Griechenland, Italien*, etc., Leipzig, 1870; L. Reinhardt, *Kulturgeschichte der Nutztiere*, Munich, 1912; *Kulturgeschichte der Nutzpflanzen*, 2 vols., Munich, 1911; W. G. Freeman and S. E. Chandler, *The World's Commercial Products*, Boston, 1911; Otto Warburg and J. E. Van Someren Brand, *Kulturpflanzen der Weltwirtschaft*, Berlin, (1909 ?).

FIG. 112. THE ZONES OF TRANSITION (PRA

This map, Fig. 112, and the preceding, Fig. 111, are by intention *exactly*
111, are here indicated by shading.

Either as a consequence of natural conditions or of human acts, the surfa
these mixed areas of woods, meadows, and cultivated fields that the principal g

The shaded zones comprise all the principal "zones of humanity"; EUR
Sudan, Abyssinia, Plateau of the Lakes, Imerina, southern border of South
AMERICA: eastern sections of the United States, etc., etc. (See the text).



Scale = 1: 160,000,000

F ELDS, AND TREES MINGLED TOGETHER)

ementary. All the populous zones of the earth, which are in white on Fig.

ce of all the zones of transition is heterogeneous, and it is in the midst of of human beings are settled on the earth.
tlantic Europe, central Europe and the Mediterranean region. AFRICA:
ASIA: the Asia of monsoons. AUSTRALIA: eastern Australia. NORTH

the coffee plant, and, very recently, a few rubber vines. What a slender contribution in comparison with all those fundamental plants which have literally fed humanity since its first existence—wheat, barley, rye, maize, rice, the potato, the date tree, the banana tree, etc. All these cultivated plants of the Old and the New World certainly go back two thousand and some of them at least five or six thousand years.

The weakness of human invention in recent times in the matter of cultivation is all the more strange and emphasizes all the more the wonder of these prehistoric selections because primitive humanity in the New World drew from nature useful plants different from those which served for food or clothing in the Old World. The only great disturbance took place after the discovery of America. Plants of the old continent spread over vast stretches of the new continent, while certain American plants—the potato, maize, the cassava plant, the cacao plant, tobacco, the tomato, etc.—invaded the Old World.

We may consider that all cultivated plants have had three primitive centers: Mesopotamia and Egypt (barley, wheat, the grape, flax); China, India, and Indo-China (rice, tea, sugar cane, mulberry, cotton plant); and tropical America (maize, potato, tobacco).[1] Almost all the cultivated plants of ancient times belong to the annual species, for at the beginning of civilization men cultivated the plants which grew most quickly and perennial cultivated plants were rare.

There is often no relation between the zone of the primitive habitat of a plant before cultivation and the immense extent which it occupies as a cultivated plant. In relatively recent times (especially since the discovery of America) it has been possible to transport plants directly to another part of the world far from their place of origin. We might even cite other than American examples, notably the *Eucalyptus globulus* of Australia which has been planted in Algeria, California, and other places with a Mediterranean type of climate.

Humanity has found and developed these principal cultivated plants to satisfy its need of food or clothing. The

[1]According to G. Martinet, director of the agricultural experiment station and professor at the University of Lausanne.

greater number of food plants are cultivated for their seed (wheat, barley, rice, maize) or for their fruit (orange, pomegranate, fig, olive, date, banana, melon, *Elæis guineënsis* or oil palm, and, for American species, tomato and pineapple); some furnish for food their tubers or their roots (turnips, carrots, onions in the Old World, potatoes and cassava in the New); finally some are even cultivated for their leaves or their stalk (cabbage and asparagus). Among textile plants, certain ones, such as the cotton plant, are cultivated for the fiber of their seed pods, but the greater number furnish man with thread from the fiber of their stalks or leaves (flax, hemp, jute, ramie, and, among American plants, century plant [*Agave americana*]).

The very early historical or prehistorical problem of how man came to domesticate animals is not a problem to be discussed here. Further, the question as to what were the first domesticated species is a less important problem for geographers than the problem of the domestic animal population at the present time. We may say, however, that according to recent studies the dog seems to have been the earliest domestic animal. Then came the ox, of which the economic rôle has been all-important, since the bovine species has been used by man both for drawing (especially the plow) and for food (milk and meat). It should also be noted that this same species in different geographical zones meets different human needs; in China the ox serves only as a draught animal and cow's milk is not used.[1] Besides the cow, the animals which were domesticated for their milk were the goat and the sheep; for drawing and carrying, the ass first, then the camel, and finally the horse. The pig is almost the only animal that has been domesticated for its flesh alone.

Man has successfully attempted the domestication of but a very small number of plants and animals.

Out of the 140,000 or 150,000 species of plants we may say that those which have a real economic and geographic

[1] Moreover, in all central and southern China breeding is applied only to small animals, no one of which furnishes milk. So true is this that, as a modern result, China, especially the great Chinese ports where important European colonies are located, has come to be among the chief consumers of European or American condensed milk. It is the cows of Switzerland, Holland, Norway, or America that nourish the little Europeans of Shanghai or Canton.

importance—that is, which are not exceptional facts or facts of luxury but current geographical facts—do not exceed 300. That hardly amounts to one cultivated to five hundred natural species.

For the animal kingdom the proportion is still less. There are entire classes of invertebrates from which man has not selected a single type; out of the entire class of the Mollusca he raises only the oyster and the clam; from the class of the Articulata, which comprises by itself ten times as many species as the entire vegetable kingdom, man raises only the bee which furnishes him with honey and some few insects which furnish silk. In comparison with the millions of species in the animal kingdom, we must estimate the species of domestic animals at the very modest number of 200.

These figures must not make us lose sight of the vast extent of the earth's surface that has been transformed by men with the help of these 300 vegetable and 200 animal species. The space conquered by these species under the guidance of man is such that, although they may appear restricted in number, the geographic importance is immense. Some brief notes on certain of the principal cultivated plants and domesticated animals, chosen as geographic types, will show this. Our purpose in this exposition of method cannot be to make complete studies (which would require entire volumes), but to try to introduce into these fragmentary sketches some principle of *geographic logic*.

3. THE PRINCIPAL CEREALS CHOSEN AS TYPES OF CULTIVATED PLANTS: WHEAT, RYE, BARLEY, OATS, MAIZE, AND RICE

Wheat

We shall consider here the present state of common wheat and the causes of its geographical extension.

It is customary to distinguish numerous kinds of wheat of which some are species; but geographically, common wheat must be considered as being one single species belonging to the family of the Gramineae and characterized by the fact that its seeds become loosened from their envelope at maturity. We shall consider the geographical conditions that determine the distribution of the different wheats without distinguishing

the different kinds: ordinary wheat (*Triticum vulgare*), Egyptian wheat or big wheat (*Triticum turgidum*), the hard wheat (*Triticum durum*) of Spain and the south of Switzerland, as well as Polish wheat (*Triticum polonicum*), and the less productive but more hardy red wheat of Alsace.

Wheat was one of the earliest cultivated plants of the Old World. It has been cultivated for at least six thousand years. It is one of the five plants solemnly sown every year by the emperor of China at the time of the celebrated ceremony instituted 2,800 years before Christ. Likewise grains of wheat have been found among the remains of the lake-dwellers and in some tombs of Egyptian mummies.

What are the geographical conditions of the cultivation of wheat that may explain its general distribution?[1]

Heat.—In order to ripen, wheat requires a rather large amount of heat, but it can ripen very quickly and this fact shortens, in certain favorable cases, the necessary period of heat. Thus wheat that requires from 250 to 270 days to mature on the coasts of the English Channel, requires only 135 days in the overheated region of Russian central Asia and, if need be, four months may suffice.

On the other hand, too great cold is unfavorable to wheat; it hardly extends beyond the regions where the temperature falls below 20°C. (68°F.), unless it is protected by an abundant layer of snow. Where cold weather without snow prevails during the winter, wheat can be sown only in the spring; otherwise it will not ripen. Thus the adaptability of this plant, the fact that the proper varieties can be sown either before or after winter, and the protection furnished it by a thick layer of snow combine to extend its geographic range.

In general, temperate winters with successive freezing and thawing are much more unfavorable to wheat than severe winters with an abundant fall of snow.

Humidity.—In order to develop, wheat needs water, especially at the planting season and during the period of most

[1]For a full presentation of the geography of wheat, see Dondlinger, *The Book of Wheat;* Hunt, *The Cereals in America*, Orange Judd Company, New York, pp. 26–137; also N. A. Bengtson and D. Griffith, *The Wheat Industry*, Macmillan, New York, 1915; V. C. Finch and O. E. Baker, *Geography of the World's Agriculture*, U. S. Department of Agriculture, Washington, D. C., 1917, 13–26.

rapid growth. Climates characterized by spring rains or where there is an abundant snowfall which melts in the spring are well suited to its cultivation. There is a general geographic correspondence between zones of abundant snow and certain zones of wheat cultivation.

However, climates that are too damp, and especially those that are too damp in summer at the time of the full maturity of wheat, are unfavorable to it. We do not find this cereal in the countries of the great equatorial rains nor in the countries that receive the heavier monsoon rains. In the monsoon countries we find wheat cultivated on a large scale only where these rains are less abundant (regions of India such as the Indo-Gangetic plain, the region of the Hwang-ho in the north of China, and the middle regions of Japan).[1] For a like reason the climate of Switzerland with its rainy summer and heavy summer showers is much less suitable for wheat than for pasture lands.[2] Similarly, soils that are too damp are unfavorable to wheat; in some regions where the upper soil is not sufficiently permeable, as in Brie, to the east of Paris, it is necessary to establish very deep drainage and more generally to plow from time to time furrows deeper than the others to facilitate the running off of the water.

While wheat does not endure well an excess of humidity, it can endure extreme dryness very satisfactorily, provided the plant receives, somehow or other, its indispensable minimum of water:

a) Wheat can resist exceptional cases of dryness because it can send its roots to a depth of from 5.5 to 6.5 feet (1.7 to 2 meters) (experiments made at Grignon).

b) Wheat adapts itself very well to very dry and permeable lands if there is beneath an impermeable layer which assures it the necessary quantity of water (Beauce).

c) Wheat also becomes easily acclimated in regions of great summer dryness, such as Turkestan, provided that the

[1]A. Woeikof contributes the following accurate observation: "It is not the abundant rains of the monsoons that exclude wheat from many regions of India, but the absence of a cool season. Wheat is a winter, not a summer, cereal. It is cultivated where there are slight but regular winter rains (the Indo-Gangetic plain), or where the monsoon rains are late in ending and where the cool season is, nevertheless, quite long (a part of the Central Provinces). Wheat is sown in November, after the rains."

[2]In Switzerland spelt especially is cultivated. Switzerland's production of cereals is equal to about one-third of her consumption; see Geering and Hotz, *Économie politique de la Suisse*, Zurich, 1903.

roots of the plant receive water in sufficient quantities by means of irrigation.

d) The wheat area in western United States[1] has in recent years been greatly extended through the use of dry-farming methods. An area is alternately cropped and fallowed so that a crop is raised every other year. The ground is constantly tilled while not in use, evaporation is reduced, and the moisture thus saved to the soil suffices to germinate and mature a good crop of wheat; though it should be noted that dry farming is most successful where the annual rainfall comes mainly in the fall and early spring. In the driest portions of the dry-farming belt a longer period of water conservation is required and a crop can be grown only once in three or four years.

Qualities of the soil.—Wheat is a plant that exhausts the soil. It needs therefore a rich soil (such as clay lands, the alluvium of rivers or lakes) either in the actual layers in which it is sown ("black earth zones" of Russia) or near these layers (Beauce).[2] Wheat is a plant so exhausting that it is best not to sow it two years in succession on the same land. It is better to allow the land to lie fallow or to alternate wheat with clover or alfalfa, which have the property of restoring nitrogen to the soil and thus enriching it. The lands best suited to wheat are the slightly mixed clays, neither too compact nor too impermeable, which the ancient glaciers spread over a large part of northern and central Europe and northern North America. They are the glacial or fluvio-glacial clays, or those finer, limey clays without pebbles, called *loess*, the origin of which is more uncertain and more

[1] J. F. Unstead, "The Climatic Limits of Wheat Cultivation, with Special Reference to North America," *Geog. Jour.*, May, 1912.

[2] "To be raised successfully, spring wheat should be sown in finely powdered soil, for, sown in heavy soil, it is likely not to attain its maximum growth. In a general way, spring wheats very rarely give a yield superior to that of autumn wheats; in fact, in certain soils, their cultivation is not to be recommended. Sown in good season and in good soil in the right condition, however, they still produce remunerative harvests in the provinces of Nord, Oise, Seine-et-Marne, Seine-et-Oise. In Beauce their success is more uncertain, and it becomes extremely doubtful in the silicate-argillitic soils of the Centre. Assuredly, in this crop, climate plays an important part, but the richness of the soil has an influence of primary importance. Only rich soil is good soil for spring wheat, while soil of moderate fertility is rather to be considered unfavorable. Even in good soils one must not forget that, because of its rapid growth, spring wheat is not desirable as a fertilizer. In soils that are light and of little fertility, it is much better to sow oats than spring wheat" (Marcel Vacher, *L'Agriculture moderne*, April 1, 1900, p. 195).

debated (loess of central Europe, loess of the United States, and the great loess deposits of China). In fact, we find wheat on all the plateaus of central Europe which have been covered by the clays or the loess,[1] and the same thing is true in North America.

Labor.—Wheat requires for the entire cycle of its cultivation a large amount of human labor:[2] plowing and sowing, harvesting and threshing.

Hence wherever wheat is cultivated on a large scale, a large force of laborers is a necessity, particularly at harvest time. What are the geographic facts that result from this? Unless the population of the cultivated region is numerous (as is the case in the upper valley of the Ganges), this cultivation brings about a call for labor, which results in a regular human migration (northern France, southern Russia, central United States, or Argentina).[3] Otherwise, man supplies the lack of labor by means of more and more perfected and costly machinery (Fig. 113). This is the partial solution of the question adopted in the great wheat plains of the central part of the United States and Canada, where reapers are used which also thresh the wheat, besides putting the grain in sacks.[4] Yet it must be noted that in the United States it is not the largest farms that raise most of the total production of wheat. Relatively small farms of less than 100 acres (40 hectares) produce a fifth of the total harvest, while the largest

[1]See the map compiled by Vidal de la Blache in his *France*, showing the history of the occupation of the soil in Europe (plateaus of Podolia, rich *Börde* of Germany, plateaus of Hainaut or of Picardy, etc.), adding to the zones marked in yellow the alluvial deposits of the Po basin.

[2]In order that this observation may keep its full value, let us note, however, that there are some periods when wheat germinates and sprouts all by itself, at least where one is not trying to cultivate it with a large crop in view. In this connection, George G. Chisholm writes: "A man at the head of a large farm in the Dominion at Ottawa called my attention to the fact that the chief reason why the first possessors of the soil had cultivated so much wheat was that it was the only crop that they could leave entirely to itself for three months after sowing."

[3]In certain regions of Italy the cultivation of wheat brings in its wake strong currents of migration; for the harvest, 75,000 Italians from other parts of Italy move to the great grain fields of the *tavoliere* of Apulia. See *Le Correnti periodiche di migrazione interna in Italia durante il 1905*, Ministry of Agriculture, Industry, and Commerce, Bureau of Labor, Rome, 1907; Pierre Denis, "Les Migrations périodiques a l'intérieur de l'Italie," *Ann. de géog.*, XVII, 1908, p. 82.

[4]Everywhere the problem of labor is growing more acute, as is that of machinery to offset the lack and high cost of labor. Hence all the efforts, in England, Germany and the United States, particularly, to introduce steam and electric power; see Ach. Grégoire, "Labourage à vapeur," *Rev. écon. internat.*, August 15–20, 1909, pp. 364–379.

quantity of wheat is raised on the medium-sized farms (from 100 to 170 acres).[1]

By means of a general map showing the distribution of

FIG. 113. STEAM-PLOW FOR THE GROWING OF WHEAT

The growing of wheat in the New World requires the most perfected and rapid machines.

wheat cultivation we can see to what extent the three chief wheat-producing countries owe their supremacy to a more or less perfect meeting of these different geographic conditions (see Fig. 114, p. 258).

1. *The United States:* (*a*) a very great summer heat; (*b*) humidity, especially during the spring and resulting largely from the melting of the snow; (*c*) glacial clays; (*d*) maximum perfection in machinery replacing hand labor.

Out of a total extent of 427,292 square miles (1,073,340 square kilometers) of the surface of the earth devoted to wheat, 83,658 square miles (1914) are in the United States. At Duluth, Chicago, and other wheat ports enormous granaries or elevators (Fig. 115) are an evidence of the gigantic wheat production of this country. Chicago, with its wheat pit, is the largest wheat market.

Storing and transportation of wheat are facilitated by the

[1]See the article by A. P. Brigham, "The Development of Wheat Culture in North America," *Geog. Jour.*, XXXV, 1910, pp. 42–56.

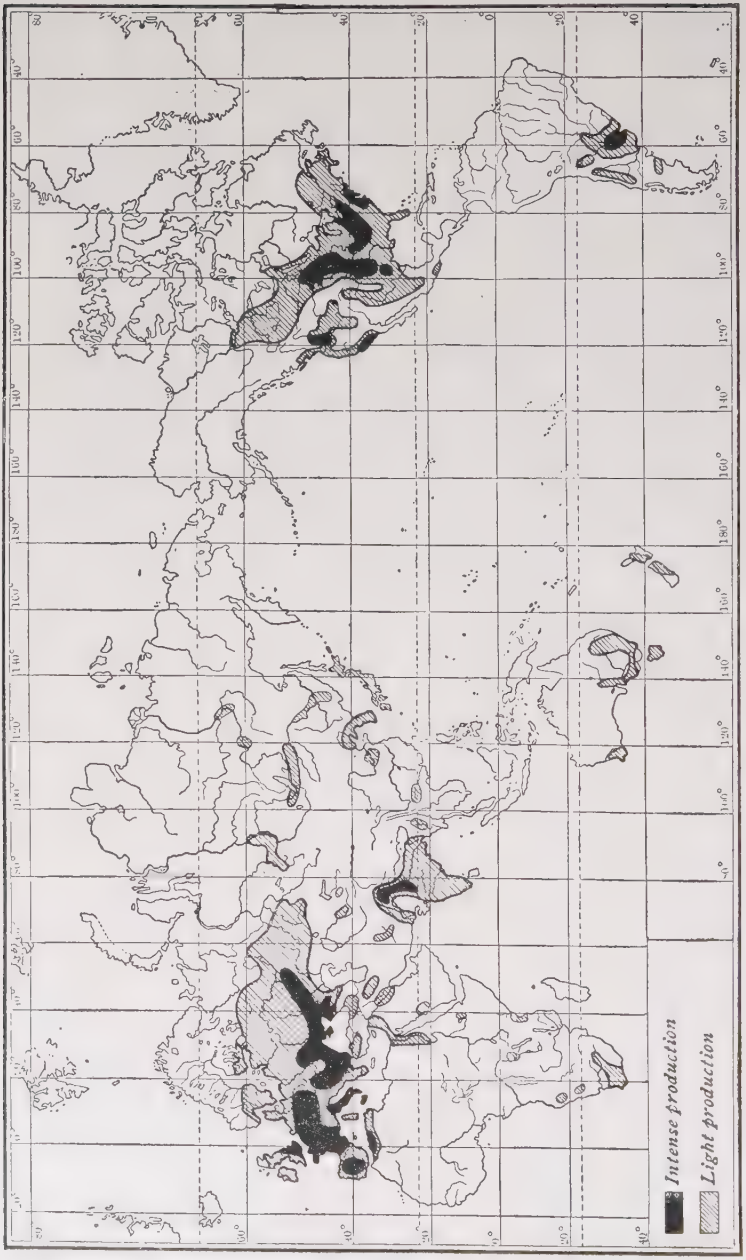


FIG. 114. GENERAL GEOGRAPHIC DISTRIBUTION OF WHEAT-GROWING

In the southern hemisphere, the wheat growing areas are between 30° and 40°; in the northern hemisphere, chiefly between 35° and 60°, the areas in the latter region tending to avoid the damp parts and concentrating in new lands between 50° and 55°.

fact that the grain can be handled more or less like a liquid.[1]

2. *Russia:* (*a*) great heat in summer; (*b*) humidity furnished by melting snow; (*c*) black earth, *chernoziom*; (*d*) periodic

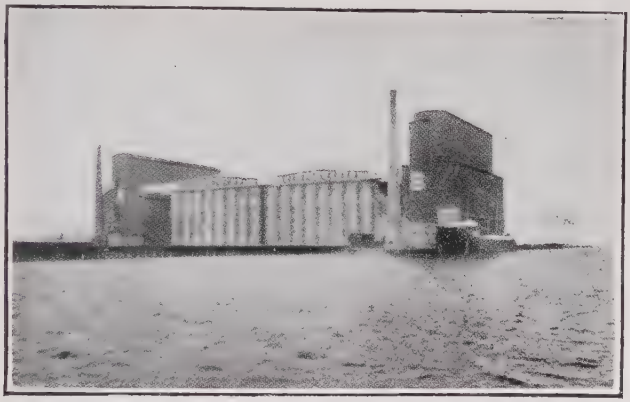


FIG. 115. A GRAIN-ELEVATOR

Situated with a lake on one side and a railroad on the other. Pneumatic tubes, large and flexible, suck the grain from the freight-cars to the top of the structure. It then runs through chutes to the holds of the carrying vessels.

migrations in harvest time of at least five to six million men from north to south; that is, from the northern sections of the "black earth country" (which are more populated) toward the southern sections.[2]

3. *France:* Here the conditions are much more varied and differ in the different regions. Almost everywhere, with the exception of the mountainous regions, the conditions of heat and humidity, while not perfect, are sufficient for wheat.[3] Generally speaking, the richness of the soil and the density of the population have been the determining factors in wheat cultivation.

To-day, in the neighborhood of Paris and particularly in

[1]See George G. Chisholm, "A Hundred Years of Commerce between England and America," *Scottish Geog. Mag.*, November, 1909, p. 571.

[2]See J. Machat, *Le Développement économique de la Russie*, Armand Colin, Paris, 1902, p. 122.

[3]See a very good chapter, "La Répartition géographique de la production du froment en France," pp. 37 ff., in D. Zolla, *Le Blé et les céréales*, Doin, Paris, 1909. Consult also, in a general way, L. Grandeau, *L'Agriculture et les institutions agricoles du monde au commencement du XX^e siècle*, Marcel Rivière, Paris, 1905–1906; and also Van Someren Brand, *Les Grandes Cultures du monde, leur histoire, leur exploitation, leurs différents usages*, translated from the Dutch by F. Rode, E. Flammarion, Paris, 1905.

Brie, the cultivation of wheat is kept up only with the help of Belgian and Polish labor. The Belgians come every year for the harvest in organized groups and are called *aoûterons*. In France the population cultivates its own wheat and eats the product; it is not, like the United States, Canada, and Russia, an exporting country.

Another chapter of true human geography should comprise a study of the dates of the harvests in the different countries. Wheat is to a remarkable degree a *world* product and the object of a *world* commerce. We may say that the wheat-producing countries have a joint responsibility and that humanity's need of wheat is such that, because of the change of seasons and the geographical situation of the different regions, there is always some spot on the earth where wheat is being gathered and threshed.[1]

TABLE OF THE PRINCIPAL REGIONS WHERE WHEAT IS HARVESTED, MONTH BY MONTH[2]

January	New Zealand, Chile.
February	Upper Egypt, eastern India.
March	India.
April	Lower Egypt, Asia Minor, Mexico.
May	Morocco, Algeria, central Asia, Persia, China, Japan.
June	Southern states of the United States, European peninsulas of the Mediterranean.
July	Central states of the United States, southern Russia, Roumania, Bulgaria, Austria, Hungary, Switzerland, Germany, France, England.
August	Northern states of the United States, Canada, central Russia, Poland, Denmark, Holland, Belgium, and northern France.
September, October	Scotland, Sweden, and Norway.
November	South Africa and province of Santa Fé (Argentine Republic).
December	Other provinces of Argentina and Australia.

After these geographical considerations it will be interesting to consult statistics. Here, for example, is the table of the wheat harvest for the year 1901 (which was a good year),

[1] Hence, as a result of the increasing facilities of transportation, has come about that "leveling of the price of essential commodities" which E. Levasseur has often studied and emphasized; see, for example, some figures on the subject of wheat "Enquête sur le prix des denrées alimentaires en France," *Rev. écon. internat.*, May 15–20, 1909, p. 247.

[2] From the "Ernte-Kalender," published by G. Ruhland in his book, *Die Lehre von der Preisbildung für Getreide*, W. Issleib, Berlin, p. 132.

compared with that of 1915, which thus far was the most productive year of all.

PRODUCTION OF WHEAT IN MILLIONS OF BUSHELS[1]

	1901	1915
United States	742⅓	1011½
Russia	405⅙	834
France	310¼	258
India	170	383
Italy	147⅓	170½
Austria-Hungary	147⅓	231
Germany	104⅔	160
Spain	76½	139
Canada	79⅓	336
Argentine Republic	73⅔	178
British Isles	53⅚	76

The total production of wheat in 1896 was estimated at 2,527⅓ million bushels.

The total production in 1915 was estimated at 4,217 million bushels.

The average annual production for the world is estimated at 3,900 million bushels.

WORLD PRODUCTION OF GRAIN, BY WEIGHT, ACCORDING TO THE LANDWIRTSCHAFTLICHE MARKTZEITUNG OF RUHLAND,[2] IN MILLIONS OF POUNDS

1900	156,747.06
1901	161,376.72
1902	190,477.44
1903	196,870.78
1904	184,304.56
1905	197,973.08
1906	203,264.12
1907	185,406.86
1908	184,304.56
1909	203,925.50

As the world market develops, not only does the cultivation of wheat become more extensive in the regions which offer the best geographical conditions, but also decreases in the countries where the geographical conditions are less perfect. Though the acreage devoted to wheat may be decreased, the crop may increase, because as wheat lands are worn out

[1]For statistics of world agricultural production, see current publications of the International Institute of Agriculture, Rome.

[2]Cited by D. Zolla, *Le Blé et les céréales*, Doin, Paris, 1909, p. 39. The figures, beginning with the year 1905, were supplied by G. Ruhland.

through extensive cultivation, more intensive methods are followed, crops are grown in rotation, and the production per acre rises.[1]

For example, the cultivation of wheat has perceptibly diminished in the British Isles, in Belgium, and in the western part of France, because the climate there is too damp, especially in summer. But the average production in these same countries for the latest per-year period (1914) for which comparative statistics are available is as follows: British Isles, 33.8 bushels (British) per acre (30.36 hectoliters per hectare); France, 18.9 bushels (British) per acre (16.97 hectoliters per hectare). On the other hand, where conditions are most favorable, the rate of production reaches only 9.4 bushels (American) per acre (8.18 hectoliters per hectare) in Russia, and only 16.6 bushels (American) per acre (14.4 hectoliters per hectare) in the United States.

Progress of the relative yield of wheat per acre in France is as follows:

1820.....11 bushels
1860.....16 bushels
1900.....19 bushels
1910.....20.4 bushels

Other Cereals of the Temperate Regions

From the study of the geographic zone of wheat, we shall now examine briefly the geographic distribution of the other cereals of the temperate countries in relation to that of wheat.

Rye[2]

Rye is first of all a more hardy plant than wheat; it can adapt itself and gets along well with: (1) a decreased amount of heat; (2) a greater amount of water; (3) a poorer soil. It also requires less care than wheat.

Rye is found along the edge of the wheat zone where wheat growing begins to diminish, and within the wheat zone where wheat does not prosper either because the soils are poor or because the climate is too damp (Limousin, Brittany,

[1] J. F. Unstead, "A Statistical Study of Wheat Cultivation and Trade," *Geog. Jour.*, 1913.

[2] V. C. Finch and O. E. Baker, *Geography of the World's Agriculture*, U. S. Department of Agriculture, Washington, D. C., 1917, pp. 27–28.

Central Plateau of France, plateau section of New York and Pennsylvania). Rye is found in the Alps up to an altitude of 6,230 feet (2,000 meters) and even a little higher. In general the cultivation of rye goes beyond the natural limits of wheat both in latitude and in altitude. It forms a sort of border around the wheat zone, and especially to the north, where the general conditions are more unfavorable to wheat-growing.

The chief rye-producing country is Russia, for the cultivation of wheat in the "black earth country" is of recent date and the people live principally upon rye; the wheat grown in Russia is intended chiefly for exportation. The countries next in order of importance as rye-producing regions are Germany, Austria and Hungary. Rye in Germany covers 22 per cent of the total cultivated surface; the proportion in Saxony reaches 26.7 per cent and in Prussia 28.9 per cent. The light, sandy, and sandy-clay lands of the North German Lowland are well suited to rye.

The increase in wheat production and the relative decline in significance of rye are in part due to changing ideals as to food. Black bread gives way to white bread, and unbolted flour to bolted flour. Improved milling methods have made it possible to transport flour through warm, damp regions, and improved methods of transportation have made it economically possible to distribute wheat and wheat flour far and wide. Many regions that once were dependent entirely upon home-grown rye can now secure wheat from the most distant wheat fields.

In Russia, the greatest rye-producing country, rye was long used extensively for the manufacture of an alcohol, the liquor called *vodka*. Whiskey too is being made from rye. In the United States, where rye has never been cultivated extensively as a food cereal, it has been cultivated for the manufacture of whiskey.

Barley

Barley is a very old cereal which has served and still serves as a food for men and animals and for the manufacture of beer. It is a richer cereal than rye and is coming to be used

much more generally as a food for human beings. Barley[1] belongs geographically to the wheat zone and in character is the most adaptable and the hardiest of all the cereals. We find it scattered throughout the wheat region, and even far beyond the farthest limits of wheat-growing. It is found far toward the north in Norway (70° N. latitude) as well as in the oases of the Sahara (as far as 25° N. latitude).

Barley is cultivated particularly in Russia and in the United States (Minnesota, North Dakota, California, South Dakota). Much of the barley has been used for making beer—a market now lost in the United States.

In a more detailed study it would be proper to distinguish between brewery barley, which is cultivated as intensively as winter wheat in central and western Europe, and barley used as food for animals, which is produced by less intensive cultivation and without fertilizer in southern Russia, in Roumania the Mediterranean countries, in California, in Chile, etc.

Oats

In spite of recent successful attempts to place oats in the list of human foods,[2] oats are still used chiefly for animals and especially for horses. On the whole, the zone of this cereal is closely bound to the zone of horse-raising. In a climate of damp and cool summers, oats succeed well; they are found in the wheat zone in regions where the summers are less warm and dry.

The chief oat-producing countries are the United States (abundant cereals), Russia, Germany, France and the British Isles.

After having thus determined, in their main lines, the zones of geographic distribution, let us examine some comparative

[1] "Barley," says Woeikof, "is the cereal which is satisfied with the least amount of warmth: so we find it at the northern limit of cereals, in the north of Russia and of Scandinavia and at very great altitudes in the Alps, the Caucasus, the Himalayas, the Andes, etc. But it is cultivated just as much to the south of the wheat region—for example, in Arabia. This first fact is explained by the rapid maturing of the barley; this allows its harvesting during the short season with very high temperature. The same reason allows the cultivation of barley in countries where the rainfall is too slight to give a good harvest of other cereals" ("La Géographie de l'alimentation humaine," *La Géographie*, XX, 1909, p. 225). See also Finch and Baker, *loc. cit.*, pp. 40–44.

[2] "Oats are the principal food for man in certain parts of Sweden, in Norway, and in Scotland, and on the other side of the Atlantic, in Nova Scotia, etc." (Woeikof, *ibid.*, p. 226). See also Finch and Baker, *loc. cit.*, pp. 35–39.

statistics, including the statistics of corn (maize), of which a brief study will follow.

PRINCIPAL CEREALS

Production, in Millions of Pounds, in the Chief Producing Countries for Three Recent and Characteristic Years

WHEAT

	1900	1909	1913
Total production	156,747.06	203,925.50	253,008.36
United States (⅕)	35,934.98	42,769.24	45,802.80
Russia	23,589.22	46,957.98	52,447.62
France	19,400.48	21,605.08	19,260.00
India	14,770.82	15,211.74	21,761.58

RYE

Total production	87,302.16	91,711.36	112,823.22
Russia (½)	51,146.72	50,264.88	58,317.60
Germany (¼)	18,739.10	24,911.98	28,870.14
Austria	3,086.44	6,393.34	6,545.58
Hungary	2,425.06	2,865.98	3,135.36
France	3,306.90	3,306.90	2,482.86
United States	1,343.77	1,805.38	2,317.33

BARLEY

Total production	39,241.88	74,515.48	99,015.90
Russia	11,243.46	22,707.38	33,455.58
Germany	6,613.80	7,716.10	10,122.54
United States	2,865.98	8,157.02	10,691.34

OATS

Total production	105,379.88	140,212.56	281,846.22
United States	30,643.94	32,848.54	67,306.08
Russia	26,014.28	36,596.36	66,335.46
Germany	15,652.66	20,061.86	40,153.86
France	9,038.86	12,566.22	18,669.42

CORN

Total production	155,424.30	208,114.24	215,245.74
United States	126,103.12	155,203.84	146,819.28
Hungary	8,157.02	10,141.16	10,601.64
Roumania	4,850.12	3,968.28	6,879.72
Italy	4,850.12	4,629.66	6,503.28
Argentina	3,306.90	9,259.32	11,798.52
Russia	1,984.14	2,204.60	4,367.58

CORN (MAIZE)

Corn (maize) is the great cereal of the New World and one of the most important products that we owe to the discovery

of America. In the Old World corn bears names which show both its late arrival and the uncertainty of different peoples as to its true origin. It is called in western Europe *blé de Turquie* (Turkish wheat), and in Turkey, *blé d'Égypte*, and in Egypt, *dourah de Syrie*.

In the Old World corn is utilized as a secondary cereal, while it is the traditional cereal of the older populations of North and South America. In Mexico the national dish is the *tortilla* (a hot pancake of corn). There are only two countries in the Old World where corn has won an exceptional place as a human food; they are Italy, where the *polenta* made of corn flour has become a national dish, and Roumania with its *mamaliga*.

Corn requires more heat and humidity than does wheat. Thus it can adapt itself to extreme, damp heat which is injurious to wheat, and can be cultivated everywhere in the tropics. It also requires an abundance of sunshine during the growing season, not maturing in regions with cloudy summers, even where the temperature is favorable (England).[1]

Two essential ideas are to be drawn from the study of corn:

1. Corn belongs to the warmer and damper zones which are situated toward the south, in the interior or on the border of the wheat zone. We shall see farther on that rice is pre-eminently the cereal of the very warm and very damp regions of the globe. Corn, by its geographical conditions, is a sort of intermediary between the wheat zone and the rice zone.[2] In two cases especially this general fact is clearly shown: in the plain of the Po, where wheat, corn, and rice succeed each other in approximately concentric zones in proportion to the humidity, and in the great valley of the Mississippi, where we find the wheat plains situated toward the north, the rice plains near the shore of the Gulf of Mexico, and the corn lands in the middle region, between the wheat and the rice.

2. Corn is a type of plant whose zone of actual geographic extension is very far from reaching its zone of possible geographic extension. Corn, a cereal of the New World, has

[1] See Finch and Baker, *loc. cit.*, pp. 29–34.

[2] In certain humid countries (as in Annam) maize is cultivated side by side with rice, but it is of quite secondary importance; it is used for food only when rice is about to fail.

as yet been introduced only here and there in a scattered fashion in the Old World where it has found so much land already occupied by the older traditional cereals. It is still to-day predominantly an American cereal, but, considering its American production, it is surprising that it should already play so important a rôle as it does in the Old World.

Let us now turn back to the table of statistics on p. 265. What does the United States do with this enormous surplus production of corn? Corn meal is not an important food in the area of surplus production, the so-called corn belt. The rural population of the southern states makes a large use of corn, but such corn is locally grown. The southern states are not a market for the northern surplus in a large way. The chief use of corn is to fatten hogs, and to a lesser extent cattle, which are raised in great numbers in the corn-growing states; and also for feeding horses and mules. Corn is grown as a grain in every state of the Union for local consumption. The corn-surplus states of the Mississippi Valley form the so-called corn belt. Corn is also grown extensively as a forage crop, especially in the dairying sections, even where the short growing season does not favor the maturing of the grain. The plant is cut when still green, chopped fine, and preserved in silos, cylindrical structures especially constructed for the purpose. Ensilage forms a vital part of the winter ration and in many cases of the year-round ration of dairy cattle, as it furnishes a succulent food that is very palatable.

Rice

As a food plant for men, rice is still more important than wheat. We may consider that rice feeds about 450 millions of men (one-third of humanity). Rice is above all others the principal food plant in very warm and very damp regions and, while wheat becomes more and more localized in the temperate regions with warm and dry summers, rice belongs especially to the tropical regions with summers characterized by heavy, warm rains.[1]

[1]Alwin Oppel, *Der Reis*, Bremen, 1890. See especially C. Bachmann, "Die geographische Verbreitung des Reisbaues und seine Intensität in den Monsunländern," *Petermanns Mitt.*, LVIII, 1912, pp. 15 and 16, Table 3. One ought, on principle, to distinguish between upland rice and lowland rice; but, economically speaking, the former has little importance. See also Finch and Baker, *loc. cit.*, pp. 46–49.

The Geographical Conditions of Rice

Great heat and *great humidity*: The countries which enjoy great heat and a large amount of precipitation throughout the year are so suitable for rice that several crops a year may be raised, as in Java. Countries which have a warm and rainy season are suitable for this plant, and the longer this season lasts the more crops can be raised. The countries *par excellence* for the cultivation of rice are the monsoon countries and the countries of southeastern Asia. In certain regions the rains of the summer monsoon are so abundant and so regular that this cereal is cultivated without irrigation; such are central and eastern Bengal, the Malabar coast, certain provinces of Java and of Indo-China. But in China, Japan, and Korea rice is cultivated only with the aid of artificial watering.

Soil: Easily worked lands, rich and in general low, for they must be not only watered but submerged; the alluvial regions of the great deltas of the Asiatic Far East are as if made ready for rice cultivation.

Labor: Very dense population, for the cultivation of rice demands many hands and continuous work. The preparation of the rice field requires very minute care. The field is divided into a series of flat basins which must not only receive the water but retain it for from eight to ten days in succession. Each of these basins is shut in by embankments which must be regularly kept up; the ground in these little basins must be prepared by plowing or harrowing (Fig. 116); then the rice must be sowed. After the rice is sowed, the fields are covered with water for twenty to thirty days, this being renewed from time to time, for it must never become foul from remaining stagnant. When the rice has sprung up, it must be transplanted (Fig. 117). This is a long, hard, and very unhealthful task. When transplanted into the basins where it is to develop, the rice must be watered at fixed periods; these waterings must have careful supervision and be often renewed. Finally, when the rice has developed, the rice fields must be drained, before the harvest begins. The rice is cut with a sickle, that is, by hand. Then there is still the husking of the grain to be done, which requires many hands.

How [says Woeikof] could a cereal so difficult to cultivate manage to take root in so many countries and become the chief article of food for hundreds of millions of men? There are two reasons for this: (1) The cultivation of rice made possible the using of marshy

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FIG. 116. HARROWING A RICE FIELD IN THE PHILIPPINES

The planting can not be done until the ground has been flooded for periods of from eight to ten days, after which it is plowed and harrowed.

grounds where other cereals would not grow; besides the yield of rice is very great. (2) It is very quickly and easily digested, conditions that are important in warm and damp countries where the other cereals cause indigestion.[1]

The cultivation of rice is mainly carried on in well-populated regions which consume most of the product at home. In order to have a surplus for export, rice must be grown where there is little local demand for the grain, labor must be cheap,

[1] A. Woeikof, *op. cit.*, p. 228.

or special methods must be employed that will permit machine labor, as has recently been done in Louisiana and Texas. The general geographic fact is that rice is mainly consumed locally in the producing countries with a dense population and a low scale of wages.

The rice-producing countries are first of all China, together with the neighboring Asiatic monsoon countries (Japan on the one hand and India and Indo-China on the other).

Rice is the essential and fundamental food of all central and southern China. In certain parts of northern China the inhabitants live upon wheat, millet, and sorghum, but the great majority of the inhabitants of China live upon rice and by means of rice. This plant, which requires no highly

From the Vérascope Richard. Engraving loaned by H. Busson

FIG. 117. THE TRANSPLANTING OF RICE

A rice-plantation at Taolongtou (Yunnan). The work of transplanting is a difficult and very unhealthful work, for it must be done with the feet in the water.

perfected agricultural tools, which demands little fertilizer but much water, which needs only four months for its complete development, is very well suited to China, a region overheated

in summer, abundantly watered by rains, rich in alluvial lands, and, finally, overpopulated.

Throughout China rice is so generally the staple food that

Jean Brunhes

FIG. 118. AFTER THE HARVESTING OF THE RICE: THE IMPRINTS OF HUMAN FEET

The men must do the harvesting with sickles, and always with their feet in the water. When the rice field has dried and, after the harvest, the mud has become hardened ground, it still bears the deep imprints of the feet of the harvesters. View taken in the rice fields of Albufera d'Alcudia (Balearic Islands).

the expression *chih fan* ("eat rice") is the current expression for "take a meal," just as the expression *chih kono fan* ("How have you eaten your rice?") is the usual formula of greeting, equivalent to such expressions as "How are you?"[1]

Rice has developed in two other groups of regions, namely:

1. The countries of Africa, and, after the discovery of the New World, the countries of America where the general natural conditions are similar to those of the Asiatic Far East in respect to heat, humidity, alluvial and marshy soils, and

[1]See Elisée and Onésime Reclus, *L'Empire du Milieu*, Hachette, Paris, p. 646. One should compare these words with some of our expressions, such as to "earn his bread."

sufficient population. In detail the regions are as follows: In western Africa: the monsoon coast of Guinea; in eastern Africa: the region of the Great Lakes, the coast of Mozambique and the lower Zambezi, the plateau of Imerina in Madagascar;[1] in South America: the humid areas of eastern Brazil; in North America: the low, warm, and well-watered region of the lower Mississippi and of the Gulf of Mexico.

2. The second type of region includes some countries with warm and dry summers where the required conditions of soil or population exist and where the lack of rain is met by irrigation (lower parts of the Delta of the Nile, lower parts of the basin of the Po).

The history of the development of the cultivation of rice shows clearly that the monsoon countries of eastern and southeastern Asia are preëminently the rice countries.

In the ceremony instituted by the Emperor Chin-Nong, 2800 B.C., which has already been mentioned in reference to wheat, the emperor himself sows every year five plants, but the first to be planted is rice.[2]

From China this plant passed to India and from India it spread to the region of the lower Euphrates, where rice was already cultivated in the time of Alexander, 400 years before Christ. At about this time it seemed to have reached the extreme limits of the summer rains and was even touching the dry and desert regions. Thus for more than a thousand years it was unable to pass beyond this limit toward the west. It was doubtless only by chance and after many attempts that rice succeeded in gaining a foothold in some parts of Syria or of neighboring countries; in those parts which are very dry it has not been generally cultivated. It is surprising that there is no mention of rice in the Old Testament; but in Palestine, which is outside of its natural geographical environment, its cultivation would have been very difficult, if not impossible.

From Syria rice must have been carried into the lower parts of the Delta of the Nile, where we still find it to-day.

The great Mussulman crusade from the eighth to the tenth

[1]The island of Madagascar was for a long time an importer of rice. Thanks to the improvement of the rice fields, it is now beginning to export this product in considerable quantities.

[2]A. de Candolle, *L'Origine des plantes cultivées*, p. 310.

century had certain agricultural consequences. It was through this movement that the Arabs introduced rice into Spain. It is still found there in certain irrigated parts, as in the *huerta* of Valencia, and it has kept its Arab name (*arroz*). Much later, rice was carried into Italy. Its first cultivation there, near Pisa, dates from 1468; thence it was introduced into the well-irrigated parts of the basin of the Po, where we find it to-day.

Finally in the eighteenth century rice was carried to the southern United States and all the low parts of the Gulf of Mexico.[1] It is now grown extensively as a commercial crop in Texas, Louisiana, and Arkansas. The development of rice-harvesting machinery has offset the disadvantage of a lack of cheap labor, so essential in the production of rice in the Orient.

Rice, which feeds so many men, plays an important part in *Nahrungsgeographie*, the geography of food; its place is less important in *Verkehrsgeographie*, commercial geography.

In Europe rice is consumed on a large scale only in Italy, where it is cultivated (50 pounds per head each year), while in Great Britain, the European country which imports the largest quantity of rice, the consumption is only 15 pounds per head.

The consumption in Germany is:

1865	1.8 pounds per head each year
1883	4.18 pounds per head each year
1900	5.73 pounds per head each year

Thus, while the quantity consumed has tripled in thirty-five years, it is still small, especially in comparison with the consumption in Italy.

The commerce in rice seems to be less centralized than is the commerce in wheat, but in some sections it is important in local trade. Japan uses rice of inferior quality imported from Chosen (Korea) and exports better varieties. Likewise in the Piura valley of northwestern Peru, Chinese rice is imported and the local rice is exported to Chile and Europe. The exportation of rice from the large, fertile, and well-populated

[1] See Leslie Harrison, "Cultivation of Rice in the United States," *Jour. Geog.*, No. 7, September, 1903; published also in *Forestry and Irrigation*, July, 1903, pp. 334–343, with, in addition, seven illustrations reproduced from photographs; reviewed by J. Nepper in *La Géographie*, November, 1903. See also Twelfth Census of the United States, 1900, Vol. VI, pp. 53–60.

island of Java in 1910 rose to 55,857 tons as against 53,100 in 1909 and 21,800 in 1908. All the rice exported is of superior quality and high price. On the other hand, Java imports much larger quantities of the cheaper grades of tea from Saigon and especially from Rangoon: 184,308 tons in 1908, 211,658 in 1909, and 425,575 in 1910.

Statistics relating to rice are incomplete for China, which certainly leads all other countries both in production and in consumption. The production in British India is approximately 55 billion pounds (250 million quintals). "Three-quarters of all the rice brought to the markets of the world is furnished by British India, and Bengal is the most productive district. Siam, China, Japan, Java, the Straits Settlements, Ceylon, the Hawaiian Islands, and the other Asiatic regions all produce a larger or smaller quantity of rice, but still not enough to satisfy the local demand."[1] According to the *Quinzaine coloniale*, the average production of rice in Japan from 1894 to 1904 was about 14 billion pounds (63 million quintals); that of Java would reach about 9 billion (42 million quintals), and that of Siam about 2 billion (10 million quintals).

Manioc and Sorghum

Manioc is a plant whose tubers serve as a food for all the black peoples of Africa and is a basal food product in tropical South America, especially in Brazil. It is, however, scattered and is far from having the importance of sorghum or durra, or the different varieties of millet. It is from manioc that tapioca is obtained.[2]

Sorghum is cultivated not only in all central Africa, but also in Japan, China, India, central Asia, and South America, and, geographically speaking, it might be claimed that it is the cereal which feeds the most men.[3]

But for sorghum, as for manioc, all accurate information is lacking; we can only mention the general importance of these

[1] *Quinzaine coloniale*, January 25, 1908, pp. 72, 73.

[2] *Manihot utilissima* is regarded by E. Hahn as a sort of elder brother of the potato. See H. Jumelle, *Les Plantes à tubercules alimentaires*, Doin, Paris, 1910; P. Hubert, *Le Manioc*, Dunod, Paris, 1910; and L. Colson and Chatel, *Le Manioc à la Réunion*, Challamel, Paris, 1906; see also Finch and Baker, *loc. cit.*, pp. 45, 102.

[3] We add here to sorghum "all the plants that resemble it" (Woeikof).

plants, the products of which have, up to the present time, contributed little to world commerce.[1]

4. OTHER TYPES OF PLANT PRODUCTION

The Olive Tree

The olive tree and the vine are two plants which belong chiefly to the Mediterranean region and to similar countries; but the olive tree is limited to the immediate shore of the Mediterranean (extreme limits in altitude: 4,593 feet in Portugal, 2,624 feet in Algeria), while the vine reaches far beyond the natural limits of this region and of this climate and extends toward the north and the east as far as the fringes of the boreal forest and the steppe.[2]

Geographical conditions.—The olive tree thrives best where there is a dry and warm climate during the summer with a mean temperature of 18° C. (65° F.) during the flowering season, and where the minimum winter temperature does not fall below −18° C. (20° F.). Light granitic or calcareous soils are best, the reddish calcareous sands being much superior to the compact clay lands. Further, olive trees require almost constant care, and trained labor is essential. The many operations of tillage, grafting, and pruning must be done just when needed; the harvesting must be timed exactly and requires hand labor (Fig. 119). Finally, olive orchards come to full bearing only after many years and then they can develop only with the help of a stable population and in an era of peace.

Geographical distribution.[3]—Portugal (very favorable throughout), Andalusia and all Mediterranean Spain, southeastern France, Italy (the richest natural province after Spain), Albania, Epirus, Peloponnesus, Crete (very rich), Asia Minor (unimportant), Palestine, and even Mesopotamia and Iran,

[1] In a complete study of the cereals, the profit which men derive from certain by-products, such as straw, would have to be considered. See chap. III, pp. 48 ff., in the book by D. Zolla already mentioned. In certain regions of Switzerland spelt and wheat have been cultivated with a view especially to the industry of braiding straw (which has now declined); see the chapter by Léon Genoud on this subject in the volume on the *Village suisse*, already quoted.

[2] The best geographical work on the olive tree is beyond question the monograph by Theobald Fischer: "Der Oelbaum, seine geographische Verbreitung, seine wirtschaftliche und kulturhistorische Bedeutung," *Petermanns Mitt., Ergänzungsheft*, No. 147, Gotha, 1904. See also Finch and Baker, *loc. cit.*, p. 89.

[3] See the map accompanying the monograph by Theobald Fischer, and the map in Bartholomew's *Atlas of the World's Commerce*, p. 169.

Tunis and Algeria,[1] and finally Morocco (very rich), are the chief olive countries.

Raoul Blanchard has published a comprehensive work on the northern limit of the olive tree in the French Alps.[2] It is a geographical study based upon careful personal investigation and proves how necessary it is that the works already published on the limits of cultivated plants be taken up again in detail. By careful analysis of the factors which explain the present northern limit of the olive tree between the Rhone and the Maritime Alps, he throws light upon and modifies a number of the earlier conclusions of Theobald Fischer. It is not the nature of the soil (there are olive trees in all soils), nor the latitude, nor even the altitude that decides the march toward the north or the withdrawal of this ancient cultivated plant—it is the exposure. A favorable exposure toward the south or the east, with effective natural protection from north, northeast, and northwest winds, explains all the apparent anomalies

Jean Brunhes

FIG. 119. THE CULTIVATION OF THE OLIVE TREE IN THE MEDITERRANEAN COUNTRIES

The soil at the foot of the olive trees is plowed; walls are constructed all about to retain the vegetable mould and the rain-water.

[1] See the works of Lecq and Rivière, Trabut, and the article by Dugast, *Rev. gén. des sciences*, January 15, 1894.

[2] *La Géographie*, XXII, 1910, pp. 225–240, 4 figures in the text and map outside the text, map on scale of 1:600,000, on which are traced the zigzags and the indentations of this real limit.

of the limit studied. "Thus the limit of the olive tree is not a true climatic limit. This is not the true frontier of the south. . . . . This is an interesting example of the extension that man can give to a delicate plant by adapting it closely to topographical conditions." These very significant statements, which are based upon many careful observations, are all the more worthy of attention because the olive tree, while preëminently a Mediterranean plant, in other places is found beyond the strict limits of this region, as for instance in all the damp coastal areas of Portugal already mentioned. Blanchard has outlined and explained the different natural regions of France, and has noted particularly the plateau of Valensole, whose inclosed valleys are covered with olive groves on southerly exposures up to the very edge of the plateau surface, which is itself devoid of olive groves. The absence of olives in the lower valley of the Bléone, where the natural conditions are very favorable, is due to a psychological factor, "the agricultural caprice of the inhabitants of the valley."[1]

The olive can grow in other regions of the globe with a Mediterranean climate. In North America it has acquired economic importance only in California; it is found also on the high plateaus of Mexico; in South America it thrives in Chile, north of 35°, and in the Argentine Republic, around Mendoza. It is also established in South Africa and is prospering in the south of Australia. This tree, which furnishes oil, belongs preëminently to regions where cattle are not raised and which are consequently deprived of butter made from cow's milk.

The Vine[2]

Geographical conditions.—The physical conditions necessary for successful vine culture are: a well-marked warm season, with no excess of rain, and land that is dry or easily drained. The labor element also is important because of the many

[1] There they prefer pear and almond trees, which grow more rapidly and bear more quickly than olive trees; the presence of a railroad, already long established, has for a long time rendered easy the marketing of these products, and in 1908 the producers of Bléone sent their pears as far as Germany (article cited, p. 302).

[2] For the geography of the vine, consult the article published by Pierre Clerget, "La Géographie de la vigne et la crise viticole," *Bull. de la Soc. neuchâteloise de géographie*, XIX, 1908, pp. 121–143: see also Finch and Baker, *loc. cit.*, pp. 84–88.

Venot

FIG. 120. THE VINTAGE IN BURGUNDY

The great vineyards of Burgundy are located about half-way up the eastern slopes of the Côte d'Or, between Dijon and Beaune. A little higher are plantations of black currants, and peach and cherry orchards. The labor element is an important factor in viticulture in particular, demanding as it does continuous human effort and a peculiar aptitude. See the text, p. 279.

different operations necessary for successful cultivation. The land must be frequently tilled; the plants need to be pruned and layered; props must be set to which the vines may be attached as they grow; spraying is necessary several times during the season. Then the grapes are picked and made into wine and the vineyards made ready for the dormant season and the next year. Where terrace culture is followed the soil itself must be replaced. There is thus a demand for continuous human effort and a peculiar aptitude the result only of long training and adherence to custom. Nowhere can vine dressers be improvised. The vine passes through many crises which can be overcome only by the most painstaking attention to the plant needs. It seems to attach the vine dresser to it in proportion to the labor it demands.

FIG. 121. THE BOURGUIGNON VINEYARD AND ITS MAKE-UP

The most important commercial places are underlined.

Geographical distribution.— "The middle zone in the two hemispheres is comprised between 27° and 49° latitude. The northern limit starts in France from the mouth of the Vilaine, runs toward Givet, crosses the Rhine near Bonn, is prolonged to the east into Saxony, turns then toward the southeast across Moravia and Hungary, crosses the Carpathians, and includes the provinces of southern Russia bathed by the Black Sea. It is found again at Astrakhan (47°) and at Peking (40°). In North America the vine flourishes in all of California, which lies south of latitude 42°. In the southern hemisphere, where the lands do not extend as far toward the pole as in the northern hemisphere, the vine is cultivated in South Africa, which reaches only 35°; in the south of Australia, which approaches some degrees nearer to the pole; in the

parts of Chile and of the Argentine Republic which are north of 40° south latitude."[1]

The limits of vine growing have changed a great deal; viticulture is withdrawing gradually from the too unfavorable

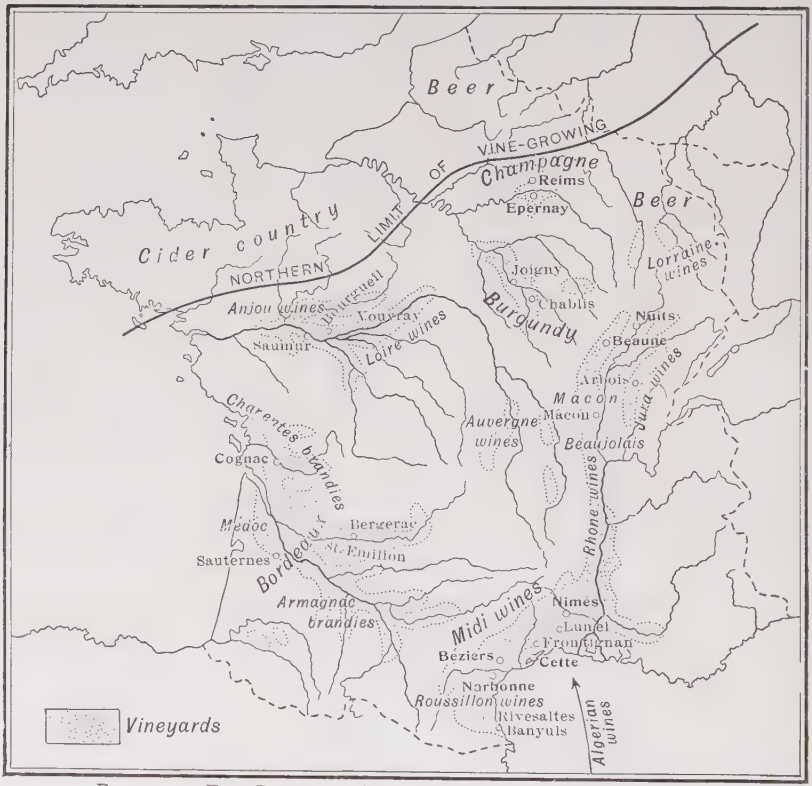

FIG. 122. THE PRINCIPAL VITICULTURAL CENTERS OF FRANCE

northern regions and is concentrating in more favored centers.[2] On the other hand, it is being established beyond its present natural limits through wholly artificial cultivation; magnificent table grapes are produced in the hothouses in the suburbs of London and in Belgium.

[1]Pierre Clerget, *ibid*, pp. 121, 122. See the map in Bartholomew's *Atlas*, pp. 90 and 91.

[2]Example: In 1889 there were not more than 70 acres of vines in Belgium; see A. Berget, "Les Vignobles en Belgique," *Rev. de viticulture*, XII, 1899, pp. 103–107 and 158–162.

Finally, the attempt at localization, which should always be the aim of geographers, would lead us to prepare, from a general map like that of the distribution of wheat-growing or of the sugar beet and sugar cane, (Figs. 116, 118) a series of more detailed maps and sketches showing the *most favorable centers*, then within these centers the *most favorable points* (Figs. 121 and 122).

Sugar Cane and the Beet

In ancient times sugar was obtained from honey, a fact which accounts for the importance which was then attached to apiculture. There is at present a renewed demand for honey and a renaissance of bee-raising.[1]

To-day sugar is derived largely from sugar cane or from beets. At the beginning of modern times (sixteenth century) ease of communication brought the product of sugar cane to our markets (about 1150 its cultivation had been introduced into Cyprus, in 1420 into Sicily and the Madeira Islands, and about 1500 into the Canary Islands). In the middle of the thirteenth century Marggraf, a German, discovered the existence of sugar in the beet and the first sugar works were established in Silesia and then in France. The continental blockade, by cutting off the cane sugar brought by English boats, brought about an increase in beet-raising in all continental Europe; but after the blockade this prosperity was followed by a terrible reverse which ruined the European sugar industry.

It was saved, however, by the scientific processes of the laboratory, through chemical analysis, and became triumphant, so that the cultivation of sugar cane in its turn was very gravely threatened and became almost non-existent. On the one hand, this menace caused the application of scientific methods to the cultivation of sugar cane, and in Java, for example, the yield per acre rose in a few years from 3,500 pounds to 9,000 or 10,500. On the other hand, the unrestricted competition of the European countries, made keener still by protective tariffs and by the tactics of exportation bounties,

[1]See the remarkable work by *T. W. Cowan*, published in English and translated into French: *Wax Craft: All about Bees Wax*, Medina, Ohio, 1908, with numerous plates and text illustrations.

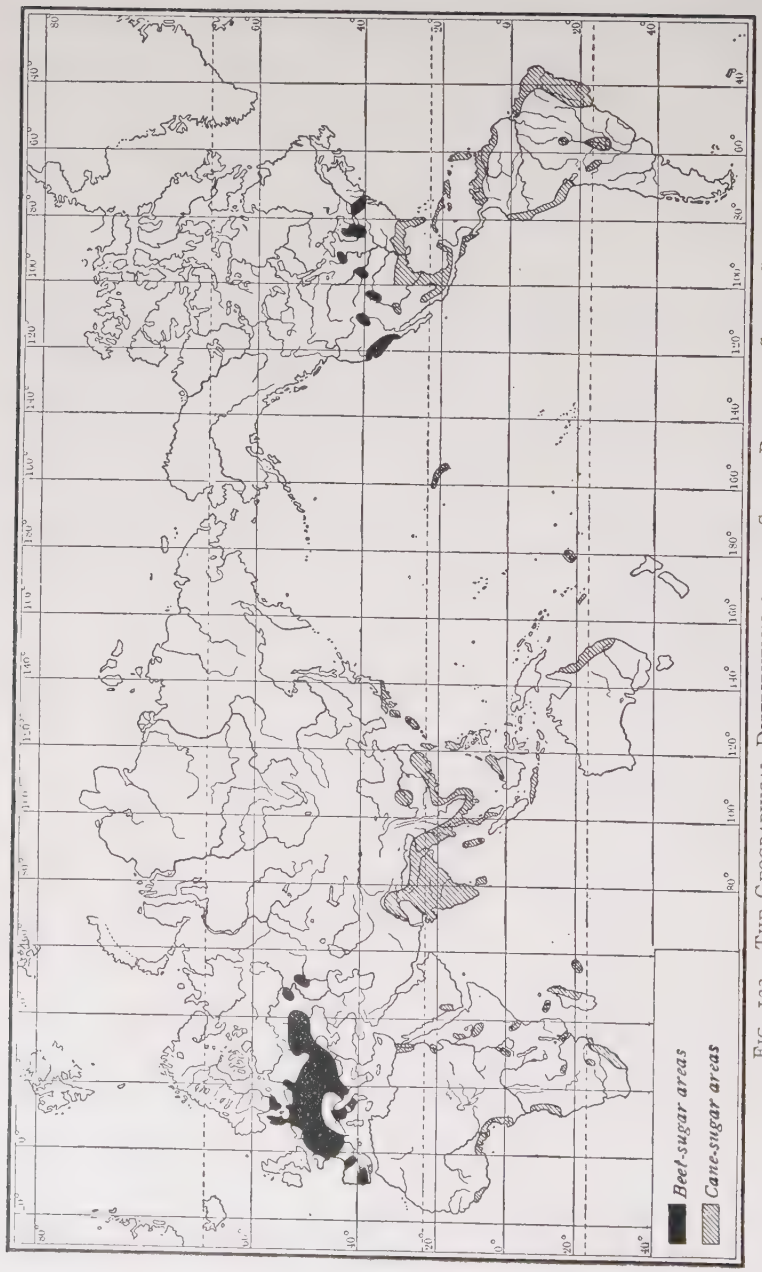

FIG. 123. THE GEOGRAPHICAL DISTRIBUTION OF THE SUGAR BEET AND SUGAR CANE

Plants which are in competition and grow in quite different geographic domains. One belongs to the transition zones near the great boreal forest and the other to the transition zones near the great equatorial forest.

ended in such great overproduction that an effort had to be made to limit the production. In this the Conference and the Convention of Brussels (1902) was finally successful. After laborious discussions, the Convention was renewed at Brussels at the beginning of 1912 for a period of five years, with some modifications adopted to the advantage of the Russian export trade.

Thus we see to what extent these two plants have been historically dependent upon each other.

Geographically, sugar cane and the beet meet in the basin of the Mediterranean; sugar cane is cultivated in the irrigated zones of Egypt and Spain, and the beet appears native in the warm districts of Spain and Portugal. However, as the struggle became more severe between the two sugar plants, they have become differentiated and separated, from the geographical point of view, so that to-day they belong to sharply opposed zones (Fig. 123).[1]

Geographical conditions of sugar cane.—(*a*) A mean annual temperature of at least 16° to 18° C. (61° to 64° F.), and especially a very high summer temperature; when the winter is severe, too early cold periods cause great losses, as in Chile, Natal, and Japan, where the cultivation of sugar cane is almost impossible.

(*b*) A heavy rainfall, at least 47 to 55 inches (1,200 to 1,400 millimeters); much water is necessary during the early period of growth, much water and heat during the middle period, much heat without too much rain at the time of harvest.

(*c*) The general tendency to transform this plant into an annual plant increases the need for labor. Further, the regions which are suited to sugar cane are fever regions and not so well adapted to Europeans; hence the introduction of negro slaves into the West Indies and into inter-tropical America.

Geographical distribution of sugar cane.—The zones which border immediately upon the great equatorial forest in both

[1]Walter Such, "Die geographische Verbreitung des Zuckerrohrs," *Beihefte zum Tropenpflanzen*, I, No. 4, Berlin, pp. 119–191. Also Surface, *The Story of Sugar*, Appleton, New York, 1910; H. C. Prinsen Geerligs, *The World's Cane Sugar Industry, Past and Present*, Altrincham (Eng.), 1912: Finch and Baker, *loc. cit.*, pp. 71–76.

hemispheres: India; Cuba and the southern states of the United States; Brazil; Java;[1] Philippine Islands and Taiwan (Formosa); Hawaiian Islands; and finally Egypt, where the growing of sugar cane has been developed by means of irrigation and cheap labor.

Geographical conditions of the beet.—Beet growing is a very exacting industry in one way; but in the other it is very remunerative. The beet is being grown in all central and western Europe on the best lands, which it makes still better because of the necessary tillage and fertilization.[2] It has played a highly important educational and economic rôle. Its cultivation requires such hard and capable labor that it is the cause of very important temporary migrations, such as that of the Camberlands in the north of France and of the Poles in all central Europe. The attempt to introduce beet cultivation on the Swiss Plateau brought about a transplanting of Poles from Galicia.[3]

Geographical distribution of the beet.[4]—The chief producing countries are Germany,[5] Austria, Russia, France, Belgium, and the Netherlands (Fig. 123).

Sugar cane and beets must be treated immediately after being harvested; their cultivation has therefore made necessary the establishment of mills near the fields.

The consumption of sugar has gone on increasing at a very rapid rate (direct individual consumption, consumption by pastry and candy-makers, consumption by chocolate factories and by factories for canning and preserving fruits, etc.).

[1]On the sugar market in the Far East and on the production in Java, see the articles published by Réau and H. Brenier in the *Bull. écon. de l'Indo-Chine* and analyzed in the *Bibl. de 1903 des Ann. de géog.*, No. 174.

[2]See Jean Brunhes, "L'Homme et la terre cultivée, Bilan d'un siècle," *Bull. de la Soc. neuchâteloise de géog.*, XII, 1899, pp. 23–24.

[3]The Poles of Galicia, for example, emigrate temporarily as far as Sweden and Denmark, on the one hand, and as far as Switzerland on the other. Recently Kasimir Ladislaus Kumaniecki, after having noticed the difference between emigration beyond the sea and these seasonal migrations which allow of return to one's country, has gathered together some interesting data with regard to this second fact; see "Die galizische Saisonauswanderung im Lichte auslandischer Arbeitsverträge," *Statistische Monatsschrift*, 1909, pp. 521–567.

[4]Van Cleef, "The Sugar Beet in Germany, with Special Attention to Its Relation to Climate," *Bull. Amer. Geog. Soc.*, Vol. XLVII, 1915, pp. 241–258 and 334–341. For a study of the beet, see particularly the investigations of the *Rev. gén. des sciences* (July 15 and 30, 1896), and the chapters by P. P. Dehérain in *Les Plantes de grande culture*.

[5]See the map by Bartholomew, pp. 78 and 79.

The English are the largest consumers (88 pounds per head per year).

COMPARATIVE STATISTICS OF THE PRODUCTION OF SUGAR CANE AND OF BEET SUGAR IN THOUSANDS OF TONS (AMERICAN)

SUGAR CANE

	1894–1895	1899–1900	1905–1906
British India	.....	2,326	2,381
Cuba	1,102	342	1,400
Java	639	816	1,113
Louisiana and neighboring states	364	353	375
Hawaii	154	353	374
Egypt	99	110	66
Brazil	276	176	292
Australia	121	121	231
British Guiana	110	99	231
British West Indies	.....	.....	187
Argentine Republic	143	132	132
Peru	83	121	165
Porto Rico	66	88	209
Philippines	253	66	165

BEET SUGAR

	Season of 1897–1898 (Before the Convention of 1902)	Season of 1903–1904 (After the Convention of 1902)	Campaign of 1908–1909 (After the Convention of 1902)
Germany	2,033	2,168	2,182
Austria-Hungary	794	1,395	1,494
Russia	793	1,279	1,433
France	852	621	827
Belgium	258	220	287
United States	404	208	463*
Netherlands	139	136	220

* 1907–1908.

How many uncertainties in such statistics as these sugar-cane figures! And how many variations in such harvests![1]

In the beet-sugar statistics there are variations also, though not so great as those for the harvests of sugar cane. Furthermore, notice should be taken of the rapid strides made by those countries which have most recently turned to the

[1]On the map of Fig. 123, Mexico and even the continental territory of the United States might seem to play a rôle more important than they play in reality in the world production. Those zones, problematical or scattered in extent (for example, in Mexico), are far from being very productive zones. To-day Cuba, the Hawaiian Islands, and the Philippines are distinctly the leading countries in their possibilities for developing the sugar cane industry.

cultivation of the sugar beet: in 1908–1909, Italy produced 190,698 tons, Spain 91,491 tons, Denmark 66,138 tons, etc.[1]

TOTAL PRODUCTION OF SUGAR CANE AND BEET SUGAR IN MILLIONS OF TONS

	Sugar Cane	Beet Sugar	Total
1890	3.0	3.8	6.8
1895	3.2	4.6	7.8
1900	3.9	6.5	10.4
1901	4.0	7.4	11.4
1902	4.57	6.17	10.74
1903	4.62	5.91	10.53
1904	4.96	5.29	10.25
1905	5.4	7.6	13.0
1906	6.5	7.4	13.9

The foregoing table demonstrates the rivalry between the two sugar-producing plants and the abnormal progress in production caused by this competition.

TEA, COFFEE, AND CACAO

These are three trees or shrubs which belong to the warm and moist transitional zones. Their products are consumed in ever-increasing quantities especially in the overpopulated regions of the temperate zones. By reason of the development of means of transportation, tea, coffee, and cacao (chocolate) penetrated almost at the same time (in the seventeenth century) into the countries of central and western Europe and they are to-day allied, as it were, for the more complete conquest of popular favor.[2] On the other hand, they often come into rivalry with each other (for instance, the substitution of the tea shrub for the coffee shrub in the island of Ceylon, of the cacao tree for the coffee shrub east of the Niger delta, etc.).

The tea shrub can endure low temperatures that kill the coffee shrub, although the two plants require approximately the same summer temperature; it follows that the coffee shrub is excluded from certain regions where the tea shrub can live without difficulty.

[1]The majority of these figures have been taken from Scobel, *Geographisches Handbuch, allgemeine Erdkunde, Länderkunde und Wirtschaftsgeographie*, Bielefeld and Leipzig, 1910.

[2]W. H. Johnson, *Cocoa, Its Cultivation and Preparation*, London, 1912.

From the *human* point of view we should group together three trees such as the date palm, the banana tree,[1] and the coconut tree. From the geographic point of view, however, they are very different and belong to widely varying zones, though for man they have the common characteristics that they meet varied needs and that all their parts are used.[2]

The Concomitants of Plant Cultivation

One last point must be emphasized. Geographers should note not only the transformations of the surface which are

Boyer

Fig. 124. The Labor in Market-Gardening

Under bell-glass, the vegetables grow in protection from the cold

Illustration from M. Allain and H. Hauser "The Principal Aspects of the Globe, France, 1912"

brought about by different sorts of cultivation, but also in detail the types of buildings and the other investments of

[1]William Fawcett, *The Banana, Its Cultivation, Distribution, and Commercial Use*, London, 1913.

[2]See, for example, for the date palm, the long note on pp. 241–242 of Brunhes, *L'Irrigation;* for the banana, a passage by Stanley, reproduced in H. Busson, etc., *Asie et Insulinde*, etc., p. 199. The banana especially is called to a brilliant economic future; it will play a larger and larger part in ordinary consumption, even in European countries; see the volume on *Les Bananiers* in the collection of *Végétaux utiles de l'Afrique tropicale française*, by Auguste Chevalier; and in the collection of the Bibliothèque pratique du colon: Paul Hubert, *Le Bananier*, Dunod and Pinat, Paris, 1907. The volume on the coco palm in the same collection is equally worth consulting.

capital that are necessary in each of these several types of human toil.

In traveling through the vineyards of the southern shore of Balaton Lake, the vineyards of the south of France, or those of the northern shore of the Lake of Geneva, one notices everywhere small structures of clay or stone which are necessary accompaniments of this kind of cultivation. Such a structure is called a *capite* in the canton of Vaud, and elsewhere *mazet, bastidon,* etc. In the small intensive market gardens around Paris, the ground is covered with large bell glasses (*cloches*) which enable the *maraicher* to produce vegetables during the spring and winter months (Fig. 124).

In Tyrol the meadows are dotted with little buildings of rough boards, usually not close fitting, which serve as a shelter for the supports, shaped like parrot perches, upon which the Tyrolese peasants dry their hay. Thus a special

Jean Brunhes

FIG. 125. STACKS OF POLES USED IN HOLDING UP THE HAY, SWEDEN

The poles are here seen set up in stacks, scattered over the Swedish meadow, before being set up in fence-like rows to support the hay for drying.

type of work, combined with the humidity of the climate, covers the ground with small supplementary facts of human geography. In countries that are still farther north, and where the summer is shorter, all the hay is set up and spread out to dry by means of vertical stakes supporting horizontal bars (Figs. 125, 126, and 127).

Mark Jefferson

FIG. 126. DRYING BARLEY ON POLES IN WEST NORWAY

Sticks projecting horizontally from the vertical poles hold up the barley, exposing it to the sun and preventing it from absorbing moisture from the ground.

Mark Jefferson

FIG. 127. DRYING HAY ON FENCE-LIKE HURDLES, WEST NORWAY

Here wires or ropes are strung between the poles, which have been set up in the sunniest spot to be found on the hillside.

In the case of rye it is still more necessary to set it up on supports, that it may resist the humidity of the climate and not absorb moisture from the soil; care is taken further to turn the hanging ears of grain toward the south, that is—toward the sun.

On the sheltered western shores of the Lago di Garda lemon trees are cultivated, the fruit of which, especially in former times, was famous and much sought after. Curious sheds consisting of white posts united at the top by cross beams,

Jean Brunhes

FIG. 128. THE CULTIVATION OF LEMON-TREES ON THE SHELTERED SHORES OF LAGO DI GARDA (RIVIERA)

Lemon-trees prosper in all the Riviera of Lago di Garda; but they need to be protected under sheds (*serre*) during the winter; that is why these posts of white-washed brick have been constructed. (However, as a consequence of the disease called "resinous flow," the cultivation of the lemon tree, formerly so flourishing, diminishes from year to year. In 1862 on the shores of this lake were produced from sixteen to eighteen million lemons; at present only from two to three million are produced.)

constructed to protect the trees from the winter cold, constitute a peculiar and distinctive feature of the landscape (Fig. 128).

The splendid table grapes from Thomery in the neighborhood of Fontainebleau, called the *chasselas de Fontainebleau*, are

M. Allain and H. Hauser

FIG. 129. CULTIVATION WITH A SPECIAL ARRANGEMENT; THE VINES AT THOMERY (SEINE-ET-MARNE, FRANCE)

grown beside walls built to protect the grapes from the wind. These little parallel walls give a distinctive appearance to this whole region (Fig. 129).

5. PLANT AND ANIMAL TYPES OF TEXTILE PRODUCTS: COTTON, SILK, AND WOOL

In comparing the geography of three of the chief textile products, cotton, silk, and wool, we have the advantage of comparing at the same time the geography of a plant (cotton), that of a tree and an insect combined (the mulberry and silkworm), and finally that of a domestic animal (the sheep).

A PLANT PRODUCT: COTTON

Cotton is at the present time the most important textile plant. It tends more and more to replace the older textile plants, flax and hemp. It is the most productive and the most generally used fiber plant in both hemispheres and in countries of different latitudes. The cotton plant belongs to tropical and equatorial regions. Cotton is spun and woven by the most primitive peoples of Sudanese Africa. It furnishes

to-day the clothing both of very primitive and of very civilized peoples.[1]

The cotton seed is in a pod, which opens of itself at maturity; it is surrounded by fibers from .3 to 1.5 inches (1 to 4 centimeters) long, and these fibers, sometimes of a dazzling white, sometimes yellowish in color, are the basis of the world's great cotton industry.

The geographical conditions of the cultivation of cotton.—Heat and humidity: The cotton plant needs high temperatures and abundant rainfall throughout the period of its growth and maturing, and hence it is principally grown in warm regions with summer rains (the Asiatic zone of the monsoons, African Sudan, southern coastal plain of America, etc.).[2]

The cotton plant is a perennial which cannot stand low temperatures; it is thus naturally eliminated from regions which are warm and damp in summer but which have severe winters. Since it was found that the best means of obtaining a good product was to pull up the plant and replace it every year, cotton has practically become an annual. As a result it can be grown in countries with moderately severe winters, provided that the summers are long and hot. Thus the southern states of the United States have become a great cotton-producing country (Fig. 130).

While the cotton plant needs much rain during its growth, it is injured by rain in the last period of its maturing. As soon as the pod is opened a heavy shower will injure the fiber, and cause it to decay. Thus the preservation of the seed is difficult in countries of monsoons and summer rains, which are admirably suited to the cotton plant during the growing season. There are other regions that may be favorable to the cultivation of cotton if the effort and expense of irrigation is undertaken; the harvest may then be more certain than anywhere else.

[1]On flax, see L. Mercier, *Monographie du lin et de l'industrie linière dans le dèpartement du Nord*, Lille, 1902; and Achille Grégoire, "La Culture et l'industrie du lin en Hollande, en Belgique et en France," *Rev. écon. internat.*, May 15–20, 1909. Since the first edition appeared, Pierre Clerget has published an excellent article on "La Géographie des textiles" in *La Géographie*, XXIII, 1911, pp. 109–132; see also A. Oppel, *Die Baumwolle*, Leipzig, 1902; E. C. Brooks, *The Story of Cotton and the Development of the Cotton States*, Chicago, 1911; Twelfth Census, United States, VI, pp. 405–420; Finch and Baker, *loc. cit.*, pp. 51–54; *Atlas of American Agriculture*, U. S. Department of Agriculture, Washington, D. C., 1918, Part V, Sec. A.

[2]See these zones of transition marked on the map in Fig. 112.

To the first class of countries, warm and naturally favorable for the cultivation of the cotton plant (India and Japan, southern United States), there is added then another geographical class: the irrigated countries with a warm and dry

Courtesy North Carolina Agricultural Experiment Station

FIG. 130. A COTTON FIELD IN NORTH CAROLINA

The pods are ripe and the cotton is ready for the pickers

summer (the oases of Egypt, of Turkestan, and of southwestern United States). (See map in Fig. 131.)

Nature of the soil: The cotton plant needs soils that are very rich, especially in phosphoric acid, and these soils must be fertilized heavily in order to meet the heavy demands which cotton makes and to maintain their fertility. In India the soils formed *in situ* from eruptive rocks (*regur*) are peculiarly suited to the cultivation of cotton. The cotton fields of the Deccan are mainly confined to this soil area. In the United States it is on the richest soils of the coastal plain and the southern prairie plains that we find cotton cultivated, and especially on the alluvial lands of the lower valley of the Mississippi.

In irrigated countries cotton is grown particularly in regions covered with alluvium.

Labor: The cotton plant requires very minute and continuous care, in the preparation of the soil, in the sowing, in

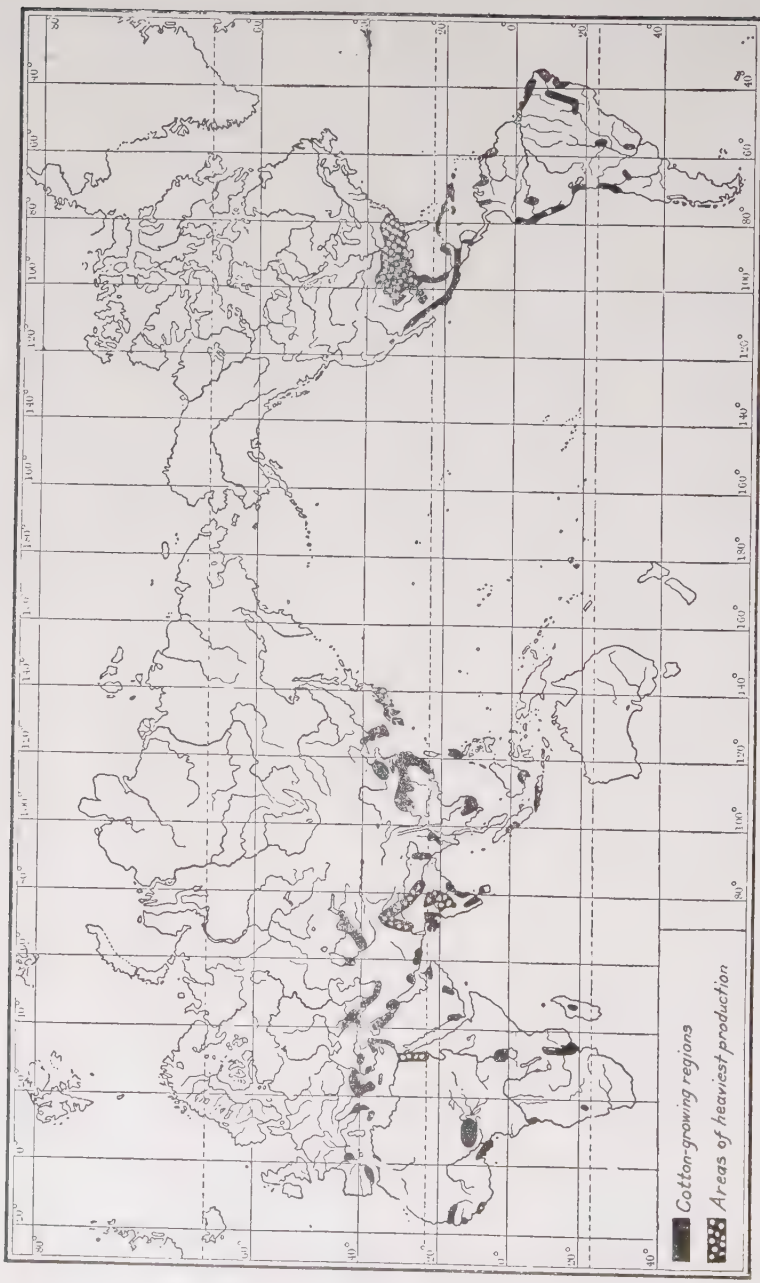

FIG. 131. THE GEOGRAPHIC DISTRIBUTION OF THE COTTON PLANT

The chief regions where it is grown are shown as dotted areas: these are naturally watered zones (India and the United States) and irrigated zones (Egypt and Russian Turkestan).

the watering in dry countries, and in the harvest, especially in damp countries. Thus the successful cultivation of cotton depends in great measure upon an abundance of cheap hand labor. In new countries which are adapted to cotton culture but which have a sparse population, labor has had to be imported, as was the case when negroes were brought from Africa to the United States. This was one of the fundamental economic causes of the slave trade and of the development of slavery on a large scale in the southern states. The Civil War was primarily a struggle for the labor necessary for the cultivation of tobacco and cotton.[1]

An Animal Product in Connection with a Plant: Silk

Several species of *Bombyx* produce cocoons which can be unwound and which furnish more or less rough silks. The *Bombyx mori*, or *Bombyx* of the mulberry tree, is the one which furnishes the most valuable thread. Geographically the distribution of silk production depends, then, upon an animal, the *silkworm*, and upon a plant, the tree upon which the silkworm lives and upon whose leaves it feeds (Fig. 132).

There are numerous species of mulberry trees: the black mulberry, the white mulberry, and the Chinese mulberry (*Morus multicaulis*). The two last mentioned, having leaves more tender and more easy to pick, are better for silkworm-raising. The mulberry is in general a very adaptable tree. It accommodates itself to northern latitudes, such as those of Norway and northern Russia, as well as to latitudes near the equator. It does not succeed at all in regions that are too clayey and too marshy, but, with this exception, it is not exacting as to the quality of the soil. It grows very well upon the dry, silicious, or calcareous slopes of the domain of the olive or of the camelia.

Judging only by the tree, then, it would seem that silk might be produced from Norway to the Sudan. As a matter of fact, the cultivation of the mulberry and the raising of silkworms have been attempted even in the countries with cold winters and springs, such as Switzerland (canton of Freiburg and

[1]See the very remarkable number devoted by the *Rev. écon. internat.* to cotton (April 15–20, 1911), the five chief articles of which are signed: E. de Wildeman, W. R. Dunstan, E. Levasseur, A. Aftalion, and C. W. Macara.

canton of Vaud), and even in Prussia (attempts of Frederick II in the eighteenth century); but most of these attempts have failed, for it is not sufficient that the mulberry develop normally; it must put forth its leaves rather early in order to serve as food for the silkworms. The climate must also be rather mild so that new leaves may grow and the tree come to maturity. Hence arises a very perceptible limiting of the distribution of the mulberry toward the north. All the countries of microthermal climates (p. 237) are excluded from it, and, still more definitely, all the countries covered by the boreal forest (Fig. 111).

Then, too, the *Bombyx* itself depends on temperature conditions. Where it develops in the open air or under simple sheds it cannot endure, during its period of evolution and of labor, a temperature lower than 15° C. (59° F.). But this period is short, lasting only about a month; and the countries where the spring period of first leaving of the mulberry coincides with a warm climate are suitable for the raising of silkworms: the damp regions of the Asiatic Far East—that is, the zone of transition of the monsoons and particularly the region of the camelia (Köppen).

However, even in these favored habitats, a chance temperature that is too cold is enough to endanger the entire growth of the cocoon. As the critical period is short, men have been led more and more to build protected sheds and have even reached the point of building closed rooms called *magnaneries*, in which the silkworm may work. During the first days a temperature of from 25° to 30° C. (77° to 86° F.) is maintained in these rooms and in the following weeks a temperature of about 20° C. (68° F.). From twenty to twenty-five days must be counted for the feeding of the caterpillar, and from four to five days for the making of the cocoon; this artificial breeding then lasts for a month. The leaves, its food, are brought to the worm, and the "climate" that it desires is made for it. All this requires only a small space and lasts only a short time. Such conditions are then easy to realize several times a year if enough mulberry leaves can be procured for these successive breedings. Moreover, it will be possible to carry on such an artificial breeding at any point on the globe,

provided that mulberry leaves can be obtained. As a result of these special conditions of "hothouse" breeding, the geographic distribution of the productive silkworm, which was very much limited by climatic demands, is now greatly extended and limited geographically only by conditions imposed by the plant and not by the animal. Silk culture has thus been able to spread out from its original center, the Asiatic Far East, and gradually to reach regions with a much colder climate and finally to establish itself very successfully in the Mediterranean region. The natural provinces where the mulberry produces its leaves early enough and abundantly enough are possible centers for the raising of the silkworm.

Here another factor comes in and determines within these natural provinces the most favored localities for the silkworm. This factor is the very one whose full economic value and effectiveness we have been trying to show in the course of this study—namely, labor (quality and quantity).

In fact, this domestication of the silkworm requires a large number of active hands, for picking the leaves, for keeping a constant temperature in the *magnanerie*, for feeding the worm, for unwinding the cocoon after the silkworm has been killed, and finally for the preparation of the eggs, which must serve for the next breeding. This is a very absorbing work, and since it is confined to a period of only a few weeks it must be performed by persons who are very careful and attentive. In Provence and in Lombardy the women are particularly apt at silk culture.

This sort of work can be carried on only where the population is rather dense and can be employed at just the time of year when the mulberry tree must be picked and the silkworm raised (Fig. 133).

In the Mediterranean countries conditions of climate are such that the mulberry furnishes its fresh leaves only once a year and in general only one breeding takes place during the year. There are species of the *Bombyx* which are called *polyvoltines* (lending themselves to several breedings per year); naturally they are raised where the climate allows the mulberry to produce leaves more than twice a year. It is the great advantage of China, Japan, Tonkin, and India that

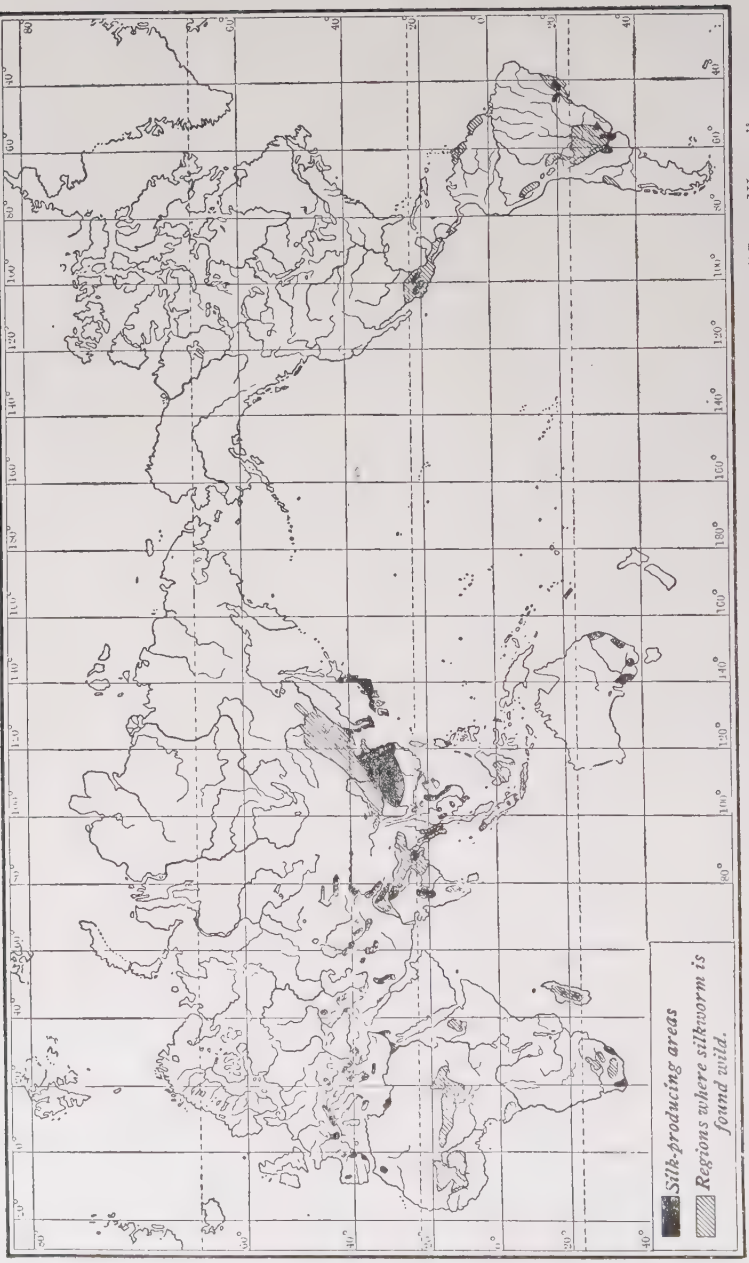

FIG. 132. THE GEOGRAPHIC DISTRIBUTION OF THE RAISING OF THE BOMBYX MORI, CALLED THE "SILK WORM," AS WELL AS OF OTHER WORMS YIELDING COARSER SILKS CALLED "WILD SILKS"

they can raise the polyvoltine species, and in these countries they have as many as four and five breedings a year.

From the human laborer's point of view, this results in a certain advantage, for those who are employed in this industry

Jean Brunhes

FIG. 133. CULTIVATION OF MULBERRY TREES IN COELE SYRIA. TYPES OF LOW TREES, KEPT SO FOR THE PURPOSE OF GATHERING THE LEAVES

The labor required in this rare and precious cultivation must be reduced as much as possible; that is why, in Provence, Lombardy, etc., as here in Syria, the mulberry trees are maintained at a height such that it is easy to reach the leaves to be gathered; the branches are usually arranged, by means of pruning, so that at six feet from the ground there is a sort of fork to which it is easy to climb.

Trees of other kinds, that likewise require delicate gathering and are well cared for, are trained in the same way; with the mulberry trees of this illustration might be compared the olive trees, the fruit of which is kept within arm's reach so to speak in all the well cultivated plains which border the slope north of the Maures range, in Provence (Carnoules, Le Luc, Argens Valley, etc.).

To the right in the illustration, are the ruins and the base of the remaining walls of the famous temple of the sun at Baalbek (ancient Heliopolis).

can devote the entire year to it. In Europe, on the other hand, only supplementary hands can be employed for the raising of silkworms. We have here a limitation set neither by the plant nor by the animal, but by the human population and by the general work in which it is employed. De Gasparin remarks that "in the south of France silkworms are not

desired in districts consisting of large farms because the farming population is too sparse. They are also unwelcome in regions given up to special sorts of cultivation, such as that of the vine, the olive, etc. Large farms are not favorable for the development of the industry, because the population of this class of farms is unwilling to care for the silkworms, while the people of the small farms are more easily interested. Finally, the breeding of the *Bombyx* cannot be carried on where crops are grown which demand much labor in the spring; in short, great estates do not in general produce silk, while, on the contrary, the industry fits in wonderfully well with all sorts of cultivation on a small scale."[1] That is why in the small French or Italian centers it is especially the women who furnish suitable labor.

Another characteristic fact which shows the curious influence of the human element upon the geographical distribution of this culture is that in India and Tibet the Buddhist peoples, who are forbidden by religious precept to kill any animal and who object therefore to the necessary artificial suffocation of the chrysalis in the cocoon, constitute a barrier to the extension of silk culture analogous to that which certain special conditions of climate might cause. Thus a psychological fact of a religious character expresses itself upon the map of the world by the distribution of a certain kind of breeding.

Unlike the manufacture of cotton, which until recent years has been developed far from the cotton-producing centers, the silk industry arose within the regions of silk worm production, or very near them.[2]

An Animal Product: Wool

From the earliest times men have had the idea of using for their own clothing the natural clothing of animals; primitive

[1] V. Groffier, "La Production de la soie dans le monde," *Ann. de géog.*, March 15, 1900, p. 100.

[2] See R. Gonnard, "L'Industrie lyonnaise de la soie et la concurrence mondiale," *Rev. écon. internat.*, August 15–20, 1905, pp. 259–299. It would be well also to note the development of that unexpected rival, artificial silk. On the beginning of these facts, see A. Ménégaux, "L'État actuel de la fabrication de la soie artificielle," *Rev. gén. des sciences*, July 30, 1898. See what has been said on this question in the last pages of Pierre Clerget's "La Géographie des textiles," *La Géographie*, XXIII, 1911, pp. 131 and 132.

peoples clothe themselves with skins. The most advanced civilization seems to be joining with the civilization of savages, for the most fashionable women more and more desire furs. The modern development of the automobile has in recent years created a great demand for furs for use in the cooler seasons.

When the fur of an animal is taken, the animal is killed. The idea of using the hair of an animal without killing it led to shearing. It was then necessary to solve the double problem of making thread and of weaving it. The natural fur of all hairy animals can be and in fact has been used for the manufacture of thread and fabrics. Goats (notably the goat of Tibet and the angora goat of Asia Minor), the camel, the alpaca (South America), etc., are sheared and their fleece made into thread of varying resistance and value.

The animal whose fleece is most used by man is the sheep. A geographic study of wool entails first a study of the geographic causes of the distribution of the sheep.

Climate.—Sheep live chiefly upon grass, but may depend also upon shrubs and dry bushes: the bushy growths (lentisks, myrtles, etc.) which cover the dry slopes and plateaus of the Mediterranean region and which form the *maquis* (Corsica), the *garigues* (Languedoc), etc. All this vegetation belongs to xerophilous or mesothermal climates (climate of the alfa, or esparto, climate of the olive), as well as to the zone of the steppes. We may say in general, for the world as a whole, that the types of climate and of vegetation corresponding to the dry parts of the Mediterranean regions are particularly suited to sheep.

Nature of the soil.—The soils which produce this vegetation are stony and often calcareous soils, which do not lend themselves well to cultivation. Calcareous soils usually have a good under-drainage. The surface is rarely water-soaked, a desirable factor in both sheep- and poultry-raising.

Human population.—In dry sheep countries the vegetation is scattered and poor and it requires a large acreage to support even a small flock of sheep. Hence arises the necessity for a constant change of place and for the periodical migration of flocks, which has led from time immemorial to the development

of well-worn trails (*drailles, carraires, tratturi, vias pecuarias*, etc.).[1]

In Italy, Spain, Provence, and Thessaly, vast flocks of sheep driven by their shepherds pass the summer on the lofty plateaus or in the high mountain regions, and in the winter come down toward the plains, where they crop either the natural grasses or the dried stalks left in the fields after the harvest.[2]

Now in order that these great journeys may be possible, the population itself must be very thinly scattered. Sheep-raising corresponds exactly to the zones of sparse population: the scantiness of population is one of its conditions. On the other hand, where a population of growing density is established and where consequently the cultivation necessary for its subsistence is introduced, sheep diminish and sometimes even disappear.

This is the all-important fact for human geography and is confirmed by many observations as well as by many statistics.

Sheep also furnish a good quality of milk, to which we owe famous cheeses, such as Roquefort. The sheep is also raised for its meat. In this case it is, geographically speaking, another animal. It is raised, for example, in regions which are unsuitable for producing a good quality of wool, but which are excellent for the quality of the flesh. Thus in Great Britain, famous as the original home of many breeds of sheep known the world over, sheep thrive from Scotland to the Downs. The better mutton breeds are found chiefly in southern England, where the equable temperature throughout the year favors the development of sheep. In some countries, as in Normandy, sheep for mutton are pastured on the fine salt grass of the "salt meadows" close to shore.

We have here a fact which is associated with entirely different geographical conditions and which should therefore be analyzed as a different and almost independent phenomenon.

[1] See especially the pages and the very suggestive maps by André Fribourg, "La Transhumance en Espagne," *Ann. de géog.*, XIX, 1910, pp. 231–244 and Plate XIV.

[2] "A grass, the *Brachypodium ramosum*, here feeds from October to June these thousands of sheep, whose periodic routes of migration, the *drailles*, we shall see furrowing the sides of the Cevennes with their white lines and reaching as far as Aubrac" (J. Sion, "La Seconde Excursion géographique inter-universitaire," *Ann. de géog.*, July 15, 1906, p. 337).

Merinos have been introduced into France with the idea of improving the fleece. "When interest in the production of meat grew," says L. Perruchot, "*English breeds* were brought in. . . . . These are great eaters and do not prosper in countries with scanty pasturage; . . . . they particularly dislike heat, dryness, dust, and drives. They prosper particularly well in the Paris basin, on the clayey plateaus, where to other favorable conditions is added the advantage of a climate that is cool without excess. . . . . " Cultivation, far from excluding sheep, makes their presence possible, as does even manufacturing. Clover, lucerne, vetches, beets for fodder, the residue of sesame, cotton seed, peanuts, and especially pulp from sugar beets are lavishly used in the sheepfold. The sheep are fed scientifically with a view to producing a food product that is almost a manufactured product.

If, with this exception, we examine the distribution of the flocks of wool-bearing sheep, we find that on the whole it is controlled by remarkably simple geographical principles. The sheep is found in all the dry, rough, little-cultivated, and thinly populated districts throughout the entire Mediterranean region: the steppes of Spain, the Cevennes and Alps of Provence, the mountains and plateaus of peninsular Italy and of Sicily, the calcareous ridges of Greece, the plateaus of Albania and Istria, the Rhodope Mountains, Bulgaria, Roumania and the great dry steppe of southern Russia and the Crimea, Asia Minor entire, Syria and Palestine, ending with the deserts of North Africa and especially with the high steppes of Tunisia, Algeria, and Morocco, the Atlas countries, which have so well deserved the name of "sheep countries."[1]

The dry zone, which is favorable to sheep, continues to the east of the Mediterranean world across the southeast of Russia and the Kirghiz steppe as far as Mongolia, and farther to the south, beyond Asia Minor as far as Iran and the dry districts of northern India. In North America, which is naturally favorable to sheep, we find a strikingly similar region, the so-called "arid region," in the western part of the United States as well as in the high Mexican plateaus. Likewise, in the southern hemisphere, dry zones similar to the dry countries of the Mediterranean, reappear in the Argentine Republic, in South Africa, and in Australia. Sheep are raised in large numbers in these three regions.

[1] See Finch and Baker, *loc. cit.*, pp. 135–141.

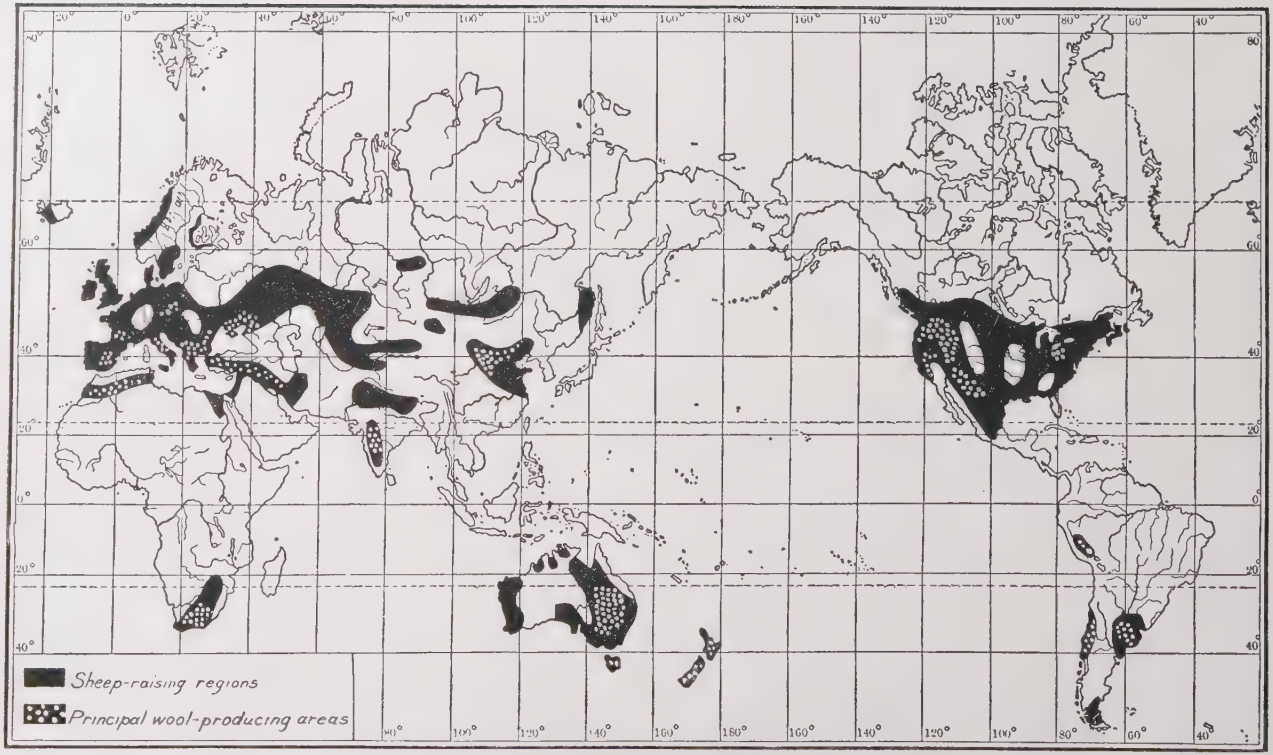

FIG. 134. THE GEOGRAPHIC DISTRIBUTION OF SHEEP

Observe, by comparison with Fig. 131, how radically distinct are the zones of the cotton plant and the zones where the flocks of sheep are raised; this fact is quite evident in northwestern India and above all in the United States.

The largest flocks in the world have been those of Australia. Introduced over a century and a quarter ago, they had reached in 1891 the formidable figure of 106 million head;

R. du Verger

FIG. 135. FLOCKS OF SHEEP IN THE HIGH MOUNTAINS IN SUMMER

The sheep of Provence (also the Algerian sheep that cross the sea to the number of more than a million every year) ascend the Alps to 6,000 feet and more in order to feed: Têtes des Cos and pastures of the Combe in the Aiguilles de l'Argentière.

See the monograph on the Aiguilles de l'Argentière published by E. Gaillard and R. du Verger in *La Montagne*, July 20, 1911, with a fine topographic map by R. du Verger.

and while the repeated dryness of several years reduced this number to 50 millions, it seems to-day to have reached once more a total of 80 millions.[1] No example could show more clearly the point to which human power may attain in a very short time in the way of animal conquest and how the methodical purpose of breeders may within a few years

[1]The whole story of sheep in Australia is summed up strikingly by Paul Privat-Deschanel, "L'Australie pastorale," *La Géographie*, XVIII, 1908, pp. 145–168, etc.

spread a multitude of new domestic animals over a country.[1]

SIZE AND TEMPORARY DECREASE OF THE AUSTRALIAN FLOCK[2]

1788	29 sheep
1801	6,757 sheep
1821	138,755 sheep
1861	23,000,000 sheep
1871	40,000,000 sheep
1881	78,000,000 sheep
1891	106,260,000 sheep
1900	92,000,000 sheep
1903	50,000,000 sheep
1906	84,000,000 sheep

APPROXIMATE STATISTICS OF SHEEP[3]

	The countries grouped geographically	About 1900			In 1910
		In Millions of Heads	No. to the Square Mile	No. to 100 Persons	In Millions of Heads
Mediterranean Countries	The Atlas countries	11	.....	.....	11
	Spain	16.5	86.2	88.3	14
	France	19.5	95.05	50.5	17.8
	Italy	7	59.31	21.2	7
	Hungary	8	64.75	42.2	8
	Greece	3	116.03	119.4	3
	Bulgaria	7	186.48	18.4	7
	Serbia	3	160.58	121.0	3
	Roumania	5.5	111.11	92.8	5.5
	Russia	52	26.93	50.0	44
	Asia Minor	....	.....	.....	....
Zones of Climate Analogous to That of Mediterranean	United States	62	17.35	81.3	51
	Uruguay	18.5	269.36	1,938.8	18
	Argentine Republic	74	66.56	1,814.0	67
	Cape Colony	12.5	43.25	520.0	15
	Australia	92	28.75	2,028.0	84
More Humid Countries	Germany	9.5	46.36	17.2	7.7
	Great Britain and Ireland	31	255.63	74.4	29

[1]From the same point of view, one might consider the influence of human intervention on the animal population of the earth by the typical example of the introduction of the rabbit into Australia. In 1862 some rabbits were taken there to be used as game for hunting; the rabbits multiplied so that to-day they are to be found by the billion; they now constitute a real economic danger, and people are obliged to preserve by means of wire fences not only their cultivated fields, but even the natural pasture grounds of sheep, against the incessant menace of these hordes of rabbits.

[2]Note besides, as J. Carpentier has truly remarked, that, while the Australian flock varies in size in such alarming proportions, exportation of wool from Australia has remained almost constant (146,000 tons in 1903 as in 1892). This comes from the raising of sheep of a cross breed, whose wool is less fine and more abundant, but which can also be exploited for their flesh (J. Carpentier, "Les Pays producteurs de laine, étude géographique." *Bull. de la Soc. de géog. de Lille*, XLV, 1906, pp. 109–123).

[3]The figures in this table were taken from Max Eckert, *Grundriss der Handelsgeographie*, Göschen, Leipzig, 1905, 2 vols., an excellent book extremely useful for reference. See I, p. 104; the figures give the size of the flocks about 1900. The figures for 1910 are from the volume by Scobel, (See note p. 286).

6. PASTORAL NOMADISM: TYPICAL FORMS; VARIED FORMS, WEAKENED FORMS; SEMI-NOMADISM

The modes of human activity connected with the raising of herds deserve particular attention as phenomena of human geography. The life and the great migrations of the horse herdsmen of central Asia[1] and the caravans of camel herdsmen in the deserts of Arabia and of North Africa are well known.

The horse is the principal animal of the great grassy steppes, and the camel that of the drier regions of the xerophilous climates (deserts) of the Old World. On the frontier of these two great types of natural regions, these two saddle and transport animals encroach upon each other's territory. The camel is found to-day in the south of Russia and in Crimea, and the horse was long ago introduced into Arabia and the Sahara, where it has even improved. Moreover, the horse has been so well chosen as a domestic animal that he finds a place in the most advanced forms of contemporary civilization and lends himself to manifold uses.[2]

Where the horse cannot endure the too severe temperature of the extreme limit of the great boreal forest, he is replaced as an animal for transport and for food by the reindeer (cold regions of high latitudes) and the yak (cold regions of high altitudes).[3]

Nor should we forget the animals that are often attached to very small human centers and to the most modest family groups. There are countries where pigs and goats are raised on a large scale, but, in the countries of old Mediterranean civilization the pig and the goat are frequently isolated

[1]See that very remarkable, though somewhat too systematic book by Ellsworth Huntington, *The Pulse of Asia*, Houghton Mifflin & Co., Boston and New York, 1907.

[2]For studies of the horse and the camel, see chaps. IV and VII in Robert Müller, *Die geographische Verbreitung der Wirtschaftstiere mit besonderer Berücksichtigung der Tropenländer*, Hensius, Leipzig, 1903. See also Otto Lehmann, *Das Kamel, seine geographische Verbreitung und die Bedingungen seines Vorkommens*, Weimar, 1891, 51 pages and a map of the ancient world showing the distribution of the two species of camel.

[3]Ed. Hahn, "Die Transporttiere in ihrer Verbreitung und ihrer Abhängigkeit von geographischen Bedingungen," *Verh. des XII. deutschen Geographentages in Jena*, 1897, pp. 181–196. See yak, p. 185; reindeer, p. 186; camel, pp. 187–190; horse and ass, p. 191; mule, p. 191; on the use of the reindeer for transportation and for food in Alaska, see the annual "Report on the Work of the Board of Education for the Natives of Alaska" (the latest, for 1914–15, being *Bur. of Educa. Bull., 1916*, No. 47, Washington, 1917).

companions of the humblest peasants. From this point of view they are deserving of a social rather than a geographical study. In Andalusia, as in the canton of Grisons, they constitute the only reserve of the poor and form a sort of living

Henry Hoskier

FIG. 136. A FLOCK OF GOATS IN LYDENBURG (SOUTH AFRICA)

"savings bank." The raising of fowls also is too general a fact of human geography not to hold the attention of any geographical observer. It is none the less true that the greater numbers of domesticated animals are raised in herds or flocks.

Since we have studied sheep as types of flocks, it would be well to examine a little more closely the phenomena of nomadism as related to sheep.[1]

The southern Carpathians, and especially the plateau of the Paringu, form one of those mountainous regions the summits of which, given over to pasturage beyond the tree-line, are occupied by the greatest number of flocks of sheep, at least during the summer period. During the winter a part of the flocks are taken into Transylvania and another part goes down

[1] E. de Martonne has collected characteristic facts concerning this nomadism in his article "La Vie pastorale et la transhumance dans les Karpates méridionales; leur importance géographique et historique." *Zu Friedrich Ratzels Gedächtnis*. Seele, Leipzig, 1904, pp. 227–245.

toward lower Wallachia, toward the Danubian steppes of Balta. De Martonne has represented the main lines of periodic movement of the sheep, roads that bear the expressive name of *Drumul oilor*, "sheep roads."

Just as we have shown the close relations between the house and the road or street, so we should note that often the phenomena of cultivation and the phenomena of domestication are closely mingled. What is *Hackbau*, i.e., cultivation with the spade, as opposed to *Ackerbau*, i.e., cultivation with the plow, except the contrast between the labor of working the earth by the human arms alone, with spade, mattock, etc., and the labor to which man has trained a domestic animal, ox, horse, camel, etc.?

It would be wrong to consider nomadism as the exclusive specialty of pastoral life. Man must, to be sure, follow his sheep, horses, or camels when he drives them from place to place in search of new pastures; this kind of toil implies nomadism, but it has no monopoly of it, and we shall have occasion to take up this important point again.

Even in countries where nomadism is a recognized fact, there are many cases of semi-nomadism representing a greater or less mixture of cultivation and animal-raising. The following description by Masqueray of the semi-nomads of the Aurès range is equally true of the people of the high Algerian steppes and the northern part of the Sahara:

> Aouras, taken as a whole, is a region too poor to admit of an absolutely sedentary life. Burned by the sun and dried by the southwest wind, grown slowly sterile since the destruction of the works of the Romans, it demands from its inhabitants the raising of cattle as well as the tilling of the soil. The Aoulad-Daoud cannot content themselves with the meager gardens at the foot of their villages which furnish them with apricots, grapes, and watermelons. They need a more fertile field in some canton of the north; they need the product of some herd. Moreover, whence would they have obtained the wool for their clothing in former times when they were always fighting with their neighbors?
>
> During the winter they work the plains of Medina and Tahammamt; they return to harvest them during the summer. In the meantime they follow their thin cattle over the slopes of the mountains of which they are masters. During the autumn they must descend to the south toward Benian and Mchounech to buy dates,

the only food easily transportable. It follows that their life is made up of regular, successive changes of place; that these people whom a superficial traveler would think sedentary are semi-nomads; that the possession of a herd is with them a sign of wealth; that the tent, although they have houses, is their ordinary dwelling; and that for four-fifths of the year their large villages are almost abandoned. Only the very poor remain in them.

The real purpose of the villages of the Aoulad-Daoud is, then, to serve as a storehouse. Each person shuts up first within his own house a small part of his provisions; then, since robbers are always to be feared, he places the main part of it in the common fortress, the *guelaa*, under the care of a guardian. A *guelaa* contains nearly all of the movable wealth of the inhabitants, considerable quantities of wheat, barley, wool, pressed dates, butter, and strips of dried meat. I saw one of them being filled at the beginning of autumn; loaded mules followed each other in an unbroken line. I must add that accidentally and rarely a *guelaa* may be isolated. This is the case at Sanef. The *guelaa* here consists of a large castle built on the very border of the *wadi*, while the village rises a considerable distance above it. This is perhaps why in maps we find Sanef on the bank of the river.[1]

For some, nomadism was only a stage in the march of humanity; for others, it was above all else a question of race. In the eyes of the former it presupposed a state of civilization which was still rudimentary, but which was destined to progress and to bring man to a sedentary life. Wherever we can follow his march, said the partisans of this idea, man was first a hunter, then a shepherd, and then a tiller of the soil. The advocates of the latter view, having noticed that nomadism is particularly widespread in Arabia and Algeria, immediately drew the conclusion that it was peculiar to the Arab family and that it was hardly capable of evolution; the Arab was a nomad, he could be only a nomad.

Thus presented, these solutions of nomadism have a grave fault. They take no account of natures restrictive influence on human activity, or of man's adaptation to geographical conditions, or of the political factor which is the result of man's will.

To take a concrete example: As far as we can go back into the history of the region, the high Algerian plateaus are pre-ëminently the country of nomadism. For a long time the government had seen its seemingly most intelligent legislative

[1] Émile Masqueray, *Note concernant les Aoulad-Daoud du Mont Aurès (Aouras)*, Adolphe Jourdan, Algiers, 1879, pp. 21–23.

plans meet with the most vigorous opposition, which some attributed to the world-old customs of nomads rebellious to ideas which disturbed their habits. Then a series of reports made on the spot under the direction of the civil and military administration in the years 1901–1903, seemed to show modifications in the customs of these peoples. In the succession of these facts there was ground for surprise and reflection. Could nomadism then be something else than a matter of race? Could it owe its origin to many factors, among which the human element played an important part, but which resulted also from the natural conditions of the country; and could the predominance of the one over the other be the key to the problem? Is it not in this direction that we might find the reason why in certain instances or in certain parts of the country nomadism offered an unyielding opposition to the laws of French colonization, while, in other instances, or in another field, it was seen to be entering upon a new phase?

On the high Algerian plateaus nomadism is naturally the "regular and periodic migration to meet the needs of pastoral life;"[1] it is the changing of place, not by some individuals only, but by a whole tribe, at fixed times and periods because it must find new pastures for the herds which furnish its food and support. But nomadism is far from showing a single type over the whole territory. There are degrees of nomadism, and, as Augustin Bernard and N. Lacroix say,[2] there is a series of intermediate types between the native of the Algerian Tell, principally a cultivator, who feels almost no need of migrating because the soil is rich enough to feed him and his herds throughout the year, and the Shaanba and Tuareg, who hardly migrate any more because they are so poor that they have no large herds and prefer to remain within the vast stretches of the Sahara with their camels, waiting for a chance to make a raid and to live at the expense of the oases around which they gravitate. Between these two come the nomads properly so called, who live by means of their herds and whose nomadism is a necessary result of geographical conditions.

[1]For this statement see Augustin Bernard and N. Lacroix, in *L'Évolution du nomadisme en Algérie*, Adolphe Jourdan, Algiers, and A. Chalamel, Paris, 1906, p. 3.

[2]*Ibid.*, pp. 77–99.

In fact, as is well shown in the work to which we refer, the utilization of the ground in the special form of nomadism is the only possible use to which it can be put on the high plateaus of Algeria—that is, in all the regions comprised between the Tell Atlas on the north and the Saharan Atlas on the south, because it can be nothing but a steppe. Cultivation can be established there only by means of irrigation and never goes beyond a very limited region. Let us not forget that the subtropical zone, to which this whole region belongs, receives less than 16 inches (406 millimeters) of rainfall in the course of the year, and that this quantity falls with a "disheartening irregularity," since more than a year may pass without a helpful shower. Let us add that such a vast extent of land does not offer everywhere the same climatic conditions nor, consequently, the same advantages to shepherds. The northern part, the region which borders on the Tell Atlas, receives spring and summer rains; the southern, or Saharan region, receives autumn and winter rains. Certain tribes are therefore obliged to have summer and winter and sometimes even spring and autumn camps, i.e., to make a regular periodic migration.

The phenomenon causes still other complications. The more numerous the tribes and the richer in flocks, the more space they require and the more they wish to extend their pasture ground. On the other hand, it goes without saying that to reach periodically the different encampments the flocks need to cross a large stretch of land, to which rights of usage must be acquired; 100,000 sheep are not transported from the Sahara to the Tell in the twinkling of an eye and without requiring water and grass. Let us suppose besides (and in nomadic countries there is ground for the supposition) that in a certain year the irregularity or insufficiency of the rainfall has considerably injured the steppe; will not the tribes be forced to seek farther for their ordinary pasture? In other words, will they not be tempted to invade the limits imposed upon them by cultivation or by the forest, rather than allow the flock, which forms their entire wealth, to perish?

Here a new difficulty arises: to abandon the forest reserves to sheep or goats means to sacrifice them, means to continue

that work of deforestation which has done all too much injury to Algeria. It even means, as a fatal consequence, the destruction of the pasturage, for it condemns to death the shrubbery, the undergrowth, which grows in the protection of the tree and serves to sustain the plant covering of the steppe itself.

On the other hand, "the extension given to the cultivation of cereals, by causing the undergrowth vegetation to disappear, is rather unfavorable to sheep-raising."[1] Thus a strip tends to form between the regions of real cultivation and the pasture regions, which, in the case of rainy years, becomes more and more infertile and impoverished; in these years it is good for neither the cultivators nor the shepherds.

We see then that the difficulties arising from natural conditions are not so easily overcome as some public men think. One of these wrote on January 8, 1904, "Is it necessary to leave more than 740,000 acres (300,000 hectares) unproductive in order to allow some hundreds of Arabs to bring their flocks there during two or three months of the year?"[2] The fair reply to this is: "Is it necessary to condemn to death several hundred thousand sheep in order to harvest some few bushels of wheat and that only in the most favorable years?" Even if it is true that the interests of agriculture are, on principle, to be preferred to the interests of extensive animal-raising, yet the former must be real and durable and we must be assured of reaping the profit from them.[3]

Cultivation cannot gain ground indefinitely in Algeria; Schirmer[4] and Brunhes stated this some years ago, calling attention to the fact that in certain oases it has acquired all the extension of which it is capable and that to endeavor to develop it over larger surfaces is to expose it to the danger of perishing where it now exists, for new borings are almost always fed at the expense of earlier ones. Bernard and Lacroix are entirely of the same opinion. "If it is possible in certain places, in the Tell or in the Hodna, better to utilize the surface water, it must not be forgotten that the larger part of these

[1] *Le Pays de mouton*, p. 47.

[2] The *Dépêche algérienne*, quoted by Aug. Bernard and N. Lacroix, in *L'Évolution du nomadisme en Algérie*, p. 61.

[3] Compare also, for these facts, Jean Brunhes, *L'Irrigation*, p. 215.

[4] *Ibid.*, p. 372.

watering-places should always be given up to watering the flocks and that cultivation should never be permitted to forbid shepherds and flocks an access to the springs."[1] There are regions where cultivation is so problematical that to attempt it is to take a real chance. This is particularly the case in the Saharan regions.

The irregularity of the rains [says a report upon the Ouled-Djellah[2] post] always makes the profit that a harvest may yield too much a matter of chance; the cultivation, without which the nomad cannot become sedentary, is always impossible in the neighborhood of the watering-places and too often causes disappointment when carried on elsewhere. Thus it is wisdom, the result of a long experience, which leads our peoples to place all their hopes in the raising of flocks. The rains follow each other with disheartening irregularity.

Only regions situated on the limits of the Tell seem destined to give more certain results; and yet the importance or the increase of cultivation mentioned in certain reports must not be exaggerated. It is a matter sometimes of 4,000 or 12,000 acres (2,000 or 5,000 hectares) for regions comprising perhaps 2 or 4 million acres (1 or 2 million hectares).[3]

We now understand the conclusion of Bernard and Lacroix:[4] "One must be hostile toward too absolute solutions, be careful not to believe in the intrinsic superiority of cultivation over grazing, and not forget that its rôle in the steppes, while increasing somewhat, can never be other than a subordinate one." If this conclusion seems too unfavorable to agriculture or too pessimistic, let us not forget that the shepherd's industry is not an evil, but a real wealth, which corresponds to the conditions of certain countries. It would be but a poor policy to take away from pasturing some few oases in the midst of the steppe to give them over to a cultivation that promises precarious results and perhaps for some few years only.[5] "But have we the right to condemn the nomads to

[1] Aug. Bernard and N. Lacroix, p. 183.

[2] *Ibid.*, p. 186.

[3] Reference is purposely omitted here to conquests which can be made in North Africa by dry-farming methods. See the preface by Augustin Bernard in the volume by John A. Widtsoe, translated by his daughter, *Le Dry-farming, Culture des terres sèches*, Paris, 1912.

[4] Aug. Bernard and N. Lacroix, p. 205.

[5] Newell, the great apostle of irrigation in the American Far West, presents some identical reservations and remarks on the economic advantages of sheep-raising. See his book, *Irrigation in the United States*.

die of hunger and make the steppes throughout unusable and unproductive in order to try to make wheat grow where the climate does not allow its existence? It is still less necessary to permit European or native cultivation to interfere with the shepherds when this interference is compensated by no advantage that is serious and of real economic interest."[1] Looked at in this light and as a function of climate, nomadism might on the whole be considered as unchangeable, and we should then have the right to conclude that the high Algerian plateau can never be the dwelling-place of sedentary peoples, for the relief and the climate of these regions can hardly be modified. However, on reading a number of reports brought together by the government of Algeria, we find that this immutability of nomadism is not complete, that changes have shown themselves for several years and even tend to become more marked. Under what influences has this evolution taken place, what agents have intervened, and why has their action not been perceptible until within a rather short time?

It is important to get a closer grasp of the problem. In northern Africa nomadism owes its origin, as we have said, to pastoral activity; the regular periodic migrations result from the necessity of finding pasture for the flocks which form the wealth of a tribe. May not other, perhaps accessory, factors have played their part in the extension of certain forms of nomadism? We know that the nomad is not only a shepherd, but also a merchant, and that the great caravans of camels, which go from the Sahara to the Tell, and vice versa, are the important means of transporting dates from south to north and cereals from north to south.[2] We know further that *nomad* is often a synonym for *pillager* and that the fine fields of barley or the verdant growth of the oases are well suited to tempt the cupidity of the nomad, who compares to them the meager vegetation of his own steppes.[3] These are facts common to all regions bordering on deserts. The Turkomans of central Asia were as great a danger to the Iranians as the

[1]Aug. Bernard and N. Lacroix, *op. cit.*, p. 63. See also Jean Brunhes, the whole conclusion of the chapter on "L'Irrigation en Algérie-Tunisie," in *L'Irrigation*, pp. 300–307.

[2]Schirmer, *Le Sahara.*

[3]On the "tufted Sahara," see *L'Irrigation*, p. 230 and Fig. 20.

sand of the neighboring desert; the Mongols, urged on by that instinct for pillage long inherent in nomads, used to invade the rich fields of China and India. We can then believe that if the geographical factor lies at the base of nomadism, the human element has been able to extend it and to exaggerate it. Might it not also restrict and reduce it?

History offers on this point a series of incontestable facts. Regions to-day trodden by the nomad or invaded by sand were once occupied by a sedentary population and devoted to cultivation. In attempting to explain these changes, before having recourse to alterations of climate, which are always very problematical, at least as far as historic time is concerned, we must see whether they may not be as well attributed to the ravages and destruction of wars. Now we may state that it was not the Arab invasion which introduced nomadism into northern Africa; to assure himself of this one need only read the testimony of authors of the first centuries who speak of the nomads of Mauretania. We know just as certainly that through the protection of the Roman armies cultivation had driven back nomadism and gained ground, without, however, reaching the regions of steppes which extend well to the south of Algiers and Oran. To the south of the Romanized territories the nomads maintained themselves. With the decadence of the Roman Empire there was a giving way on the part of the cultivator and a forward movement by the nomads which, though arrested somewhat under the Byzantine rule, started again with the Arab invasion of the seventh century. Some authors have thought that this invasion had spread a nomadic population over these regions. It was rather the invasion of the twelfth century which established as many as 500,000 nomads in these lands and added to the evils of war the evils arising from their type of life and habits. "It is their sheep, their camels, their goats, that ruin northern Africa."[1] The Turkish administration was still less than to-day of a sort to encourage agriculture; the incessant intertribal wars and the periodic raids of the bey could only weaken and even bring to naught the efforts of the sedentary population constantly deprived of the fruits of their labors. Why

[1]Aug. Bernard and N. Lacroix, p. 26, and farther on, chap. X.

wear one's self out, if at harvest time the harvests were to be carried off by the robber of the desert or the robber of Algiers? But a failure to work on the part of the sedentary population means the ruin of agriculture, for we must not forget that "in dry countries, such as the Mediterranean countries, and with all the more reason in the steppes and the Sahara, there is no need of positive injury in order that the soil should depreciate, the forests perish, and nomadic life gain ground. Negative action is sufficient; it is sufficient to do nothing, not to keep up the hydraulic works, and not to busy one's self with waters and forests."[1] To how many other countries would a remark of this sort apply? We might say that all the regions bordering upon deserts, all the zones marked as steppes on the map of Fig. 111, would furnish us with examples, but Mesopotamia, Russian and Chinese Turkestan, the plateau of Iran, and Mongolia are the most significant in the Old World.

In the New World we have an excellent example of seasonal nomadism in the case of the Navajo Indians of New Mexico and Arizona. Though they cultivate favorable soil areas in the lowlands to a moderate degree, their chief form of wealth is sheep. These they drive into the forest and grassy high mesas in the summer, where the higher humidity favors the growth of succulent vegetation. In the winter season the flocks are driven to the lower levels (below 7000 ft.) and are fed on the dry nature-cured hay that has grown during the summer.

If the state of war, the insecurity which is the fatal consequence of it, the absence of a vigilant and firm administration, give to the nomad every facility for developing and putting in action his instincts for idleness and pillage, while at the same time permitting him to feed his flocks and herds upon lands which cultivation might claim, we can on the other hand understand that the man of sedentary life, feeling himself protected, and assured that his toil will bring him an abundant and paying harvest, will no longer fear to push his cultivation to the limits where climatic conditions favor it. He will retake the land which he had abandoned and we shall see a drawing back of nomadism.

[1] Aug. Bernard and N. Lacroix, p. 29. See also Brunhes, *L'Irrigation*.

This drawing back, however, is only an outer aspect, affecting the region much more than the institution itself. Changes in the state of the nomad would be much more important and much more significant. And that is exactly what has happened upon the high Algerian plateaus where Bernard and Lacroix made observations which show not merely a withdrawal of nomadism, but a *transformation*, a veritable *evolution*.

The nomad or the shepherd can devote his energy to different sorts of animals, and there is a whole series of transitions, including the raising of the horse, the goat, and the sheep, between the nomad who raises cattle and him who raises camels. We may disregard cattle-raising, since cattle, requiring fodder and water, can live only rarely in the steppes. As for the horse, which is essentially the animal of the steppes, its raising also presents some difficulties. The requirements are more rigid than in the raising of sheep, and even of the ox; yet it is well known what a place the horse holds in the life of the Arab and how the Prophet made the care to be given to horses one of the obligations of Mussulman life. And why was this? Because the horse was essentially a war animal. There is nothing more typical on this point than the words of the emir Abd-el-Kader: "It has been a part of the customs and nature of the Arabs from the earliest times to make war upon each other, as well as upon neighboring nations. The poor Arab needs a horse in order to fall upon the goods of his enemy, take possession of them, and grow rich, and the rich Arab likewise needs a horse to protect his fortune and his head."[1]

The consequences of the French occupation and the pacification which has been the result of it are now easily seen. Why keep an animal, the price of which has risen, the support of which is costly, and which no longer renders the service that was once expected of it? Consequently we see that horse-raising is steadily decreasing, while the raising of horned cattle and of the mule is increasing. The horse has become more and more a luxury. This is a natural consequence of peace and does not fail to disturb the government. "Some

[1]Aug. Bernard and N. Lacroix, *op. cit.*, p. 114.

years ago," says the report from the "circle" of Khenchela,[1] "it would have been easy to find in Algeria 20,000 horses ready to be equipped and placed immediately in service. This was a valuable asset for the state, but one which unfortunately no longer exists, and if the government does not take measures to stop the emigration of colts, it is clearly evident that before long it will be impossible to provide for the recruiting of the horses necessary for the cavalry in Algeria."

There is modification also in camel-raising. The camel, as we mentioned above, is particularly adapted to the desert, where it plays an important part, either as a pack animal or as a saddle animal; yet it has not the endurance that is commonly supposed. As a result of their use by the Algerian troops the camel herds were decimated to such an extent that the effective force had fallen from 255,000 in 1896 to 187,000 in 1901. This mortality, aggravated further by the dryness and severity of the winter of 1903–1904, caused the price of camels to rise. Sums of money were granted by the government for building up the herds, but many natives have bought cattle and sheep. Why? On this point it is interesting to read the reports of officers. "In the 'circle' of Marnia, insecurity having ceased, the native is no longer obliged to change his dwelling quickly and to flee before swift and numerous enemies; his camel is therefore less useful to him." "In the 'circle' of Méchéria the usefulness of camels for the natives is decreasing because they wander less and less, and the railroad is competing with transportation by caravans. Moreover, the decrease in camels is not to be regretted; cattle and sheep will take their place to the advantage of the country." In other regions which are deserts or on the edge of the desert and where consequently great migrations are necessary, camel-raising holds its own and cannot be neglected. We find here the influence of the human element as a geographical factor. The security enjoyed by the sedentary peoples and the building of railroads have made the camel useless both as a pack animal and as a war animal; it is giving way to the sheep, which is truly the animal of the Algerian steppe. Care should be taken not to interfere with the growth of the flocks

[1] Aug. Bernard and N. Lacroix, p. 116.

of sheep through measures too restrictive upon grazing or too favorable to cultivation. According to Bernard and Lacroix, the best thing would be, not to sacrifice cultivated lands or forests, but to substitute intensive for extensive sheep-raising by care of the pasture lands, by the development of watering-places, by a better utilization of the actual resources.

That there is ground for such a proceeding, and that great advantages may be hoped from it, is shown by the results obtained in other countries. "In Australia in the Murray basin, the irrigation projects have allowed the creation of fields of alfalfa; thanks to this plant, 15,000 sheep are fed upon 200 acres, or 75 per acre, while formerly in the same country it required 4 acres to feed 5 sheep."[1]

Another factor which is modifying the conditions of nomadism is the commercial factor, or rather the changes which it is undergoing. Formerly it was necessary to organize great caravans in order to send to the markets of the Tell the flocks, the wool, and other products of sheep-raising, and to bring back grains and divers manufactured products. But to-day the railroads have penetrated to the very edge of the desert and have facilitated the establishment of depots, of places of exchange, of commercial centers. Owing to the relative security of the roads, "we see to-day merchants and commercial travelers, Jews or Mozabites, soliciting the trade of the nomad even in his tent and offering him the objects which he needs."[2] Another fact no less significant is that "the weekly market has in more than one spot replaced the annual fair."

This evolution has, moreover, taken place elsewhere under the influence of the same agents. The great caravan routes for tea and silk in central Asia are disappearing as a result of the coming in of the railroads; commercial centers are changing place; the great annual fairs have given way to more frequent markets, and in Europe, too, the merchant, the commercial traveler, penetrates to each village, to the smallest hamlet, and solicits the trade of the peasant under his thatched roof.

The coming in of the European has had its influence in

[1]On the subject of irrigation in the Murray basin of Australia, see Paul Privat-Deschanel, "La Question de l'eau dans le bassin du Murray," *La Géographie*, December 15, 1905, p. 466.

[2]Aug. Bernard and N. Lacroix, p. 226.

another form—that is, in the habits of daily life. While formerly the nomad lived chiefly from the product of his flocks and clothed himself with fabrics of native manufacture, now he has recourse more and more to the products of Europe. "The use of coffee, sugar, and tea is making its way into the houses of the rich; even among people of moderate means these articles are considered necessities." "European clothes, fabrics, and tapestries are beginning to excite their desires; many natives are even beginning to wear shoes of the European style."

"To-day," say Bernard and Lacroix,[1] "the weaver works quickly, puts less wool into the fabric, and replaces it by cotton in the warp; in the woof he uses wool colored with aniline dye instead of wool colored with vegetable matter."

Passing through an evolution in grazing, in commerce, and in industry, the nomad seems also to be passing through an evolution in his social organization, and here again we see the influence of the human and political factors. Perhaps a change may be made in the Mussulman family in the matter of polygamy. Certain authors hope that, because domestic tasks will be less numerous and less binding, the Mussulman, having less need of servants, will take fewer wives.

That there is an evolution in nomadism in Algeria is then undeniable; some of the changes take place before our very eyes: "A tendency to reduce the migrations, a decadence in camel-raising and progress in cattle-raising, a progress in cultivation, a tendency to build houses, an increase in luxury, an increase of individualism in the family, a growing freedom of the family and of the village in relation to the tribe."[2] However, these changes seem to have shown themselves much more in semi-agricultural tribes near the Tell, in those which are along the limit of the steppes; they have affected much less those which live in the midst of the steppes or in the Sahara. In other words, the evolution is more marked in regions where nomadism owed its existence and development to undoubted physical factors, but also in large measure to human factors, the insecurity of the country, and low density of population. The evolution is much less marked in parts where nomadism

[1] Aug. Bernard and N. Lacroix, p. 267.

[2] *Ibid.*, p. 302.

is chiefly the result of truly geographical conditions. However, nomadism has expressed itself here by a number of facts important enough so that we can say that it is not a matter of race, that it is not of a single type, and that it is not unchangeable. On the other hand, the resistance that it offers to a too rapid change shows that it rests upon natural conditions that are difficult to modify.

On the transformation of the periodic migration in Spain, A. Fribourg has lately published some important data.[1] Since the new rates and the new means of transportation inaugurated in 1899 by the Madrid-Saragossa-Alicante Company and in 1901 by the Madrid-Cáceres-Portugal Company, "the sheep migrate in cars." Besides, in many countries and notably in Spain, the raising of sheep implies a diminishing migration. In the fifteenth century there were 2,694,000 migrating sheep, while at the end of the nineteenth century there were not more than 1,355,000, and that is but a very small part of the total number of sheep in Spain, which certainly reaches nearly 14,000,000 head.[2]

We cannot end this chapter without saying a word about Alpine nomadism, or the nomadism predominant in the Alps and the mountains of humid Europe, i. e., central and western Europe.

Alpine nomadism is especially associated with the raising of cattle.[3] The pastoral migrations of cattle in the Alps differ from the nomadism connected with the raising of sheep in that they are always migrations for a short distance; moreover in moving from their winter station to their summer pastures, the herds do not have to traverse entire zones occupied by

[1] André Fribourg, "La Transhumance en Espagne," *Ann. de géog., XIX*, 1910, see p. 375.

[2] In many parts of the Pyrenees nomadism is, on the contrary, allied with the raising of sheep.

[3] Dr. Joseph Girou, of Aurillac, on reading this paragraph wrote: "It is not only in Spain that they pay railroad fare for animals that migrate. The cows of our country have no reason for envying the Iberian sheep. The mountain pastures of the canton of Allanche and of the neighboring cantons (situated to the north of the department of Cantal) are excellent and are very much sought after by the herdsmen of the neighborhood of Aurillac, to the south of the department; but they are far away and there is no way of getting at them by a direct road. So, when the new line from Neussargues to Bort, which crosses the country of Allanche, had been opened a short time, the herdsmen asked the Paris-Orleans Company to make special trains for cows; the company arranged for such trains, and they are used especially for the animals having the longest journey to make."

forms of exploitation of the earth that are entirely different.[1]

As we have found in the case of sheep, it would be a mistake to reduce Alpine nomadism to a single formula. There are cases where cattle-raising brings about a whole series of regular migrations with fixed establishments, and no example is more representative than that of the Val d'Anniviers; but there are other cases where the migrations are so slight and affect such a small number of human beings that we might say that there is no nomadism, properly speaking, and this is chiefly the result of general geographical conditions. The high Swiss valley of the Valais (Val d'Anniviers) is a type of what may be called nomadism at its highest power. In the same Valais, some dozens of miles from the Val d' Anniviers, is the valley of Conches — a high valley without nomadism or with nomadism that is very restricted.

The valley of Conches, the upper section of the Valaisan Rhone, has an essentially pastoral population.[2] Everyone owns some cattle or sheep, often both. For 4,204 inhabitants (in 1900) we find 4,723 head of cattle of which 2,240 were cows. There are few regions in Switzerland where the proportion is as large. The cow is here the unit of wealth; formerly, as in Homeric Greece, a young bride received a cow as a dowry. Pasture animals and cheese are almost the only merchandise exported from Conches. Cattle products furnish almost all the native food including meat, and especially milk and its products, butter, cheese, and curd. For the native of Conches cheese plays the part that bread plays elsewhere.

As a matter of fact the climate (three months only have a mean temperature above 10°C. [50°F.], and the altitude (more than 3,200 feet) are not favorable for agriculture. The fields are upon slopes so steep that they cannot be worked with the plow, and transportation has to be upon the backs of men. The spring frosts sometimes destroy the meager crops, especially in Haut-Conches and in the valley of Binn.[3]

[1]On cattle-raising in France, see Henri Hitier, "La Répartition des races bovines en France," *Ann. de géog.*, XII, 1903, pp. 450–453.

[2]In 1907 Charles Biermann presented at the University of Lausanne a thesis on human geography: *La Vallée de Conches en Valais, Essai sur la vie dans une haute vallée fermée des Alpes suisses sous l'influence de l'altitude, du climat et du relief*, Imprimerie réunies, Lausanne, 1901.

[3]See Léon Desbussions, "La Vallée de Binn," *La Montagne*, IV, 1908, pp. 221–230.

The higher pastures are the only resource of the country. They cover 21,497 acres (8,700 hectares) out of a total area of 130,641 acres (52,870 hectares), of which 63,504 acres (25,700 hectares) are unproductive. They are especially important in the regions poor from the agricultural point of view, where not only the population maintains its position, but where it established itself from the beginning. On the other hand, where pastures have been destroyed by an excessive deforestation, as in the Gerenthal, there was a loss of population in spite of the good exposure of the fields and meadows.

Most of the pasture lands are on the left bank of the Rhone, where the more numerous mountain chains are less high, where the lateral valleys are deepest, such as those of Egesse and Binn, and from which, finally, the unfavorable exposure (shady side) excludes cultivation, established only at the expense of the forest and the pasture. The villages are, however, in general grouped upon the other (right or west) bank at the foot of the sunny slope in the midst of the cultivated fields.

The herds pass the winter in the village, go in the spring to the *mayens* (midseason pastures), then stage by stage, as the summer advances, they go up the grassy slopes to the upper limits of vegetation. In the early autumn they come down as slowly as they went up and end the season in the stables scattered amid the low meadows.

Restricted as the development of this nomadism is in the matter of distance (and doubtless for this very reason), the inhabitants have but a very small share in it. A few women and children accompany the animals to the *mayens;* three or four herders only follow them to the upper pastures to make the cheese. The other inhabitants of Conches remain in the village.

This is not at all like what happens in the Val d'Anniviers, where continual migrations constantly transport the entire population from the valley to the plain and from the plain to the mountain and oblige each family to build a house at each one of these stops. The cause of this difference is to be sought in the frequency and violence of the avalanches and torrents which restrict the available surface of Conches,

depriving of population even the districts which are richest in vast pastures.

In this upper part of its course the Rhone itself is only a torrent whose extreme and rapid rise at the time of the melting of the snows exposes its banks to disastrous floods; most of the villages therefore avoid its immediate neighborhood. Its affluents are still more to be feared. The clearing of the inhabited slope of the valley has given them a torrential character, and at their meeting with the Rhone their deposits form numerous cones, sometimes of considerable size, which the avalanches sweep away every spring. This last scourge is the most terrible of all. The avalanche more than anything else ruins crops, destroys houses, and even causes deaths. It compels villages to crouch on the edge of alluvial cones; it causes the gathering of the population in close groups with hardly a single dwelling standing by itself (see chap. III). The avalanche is moreover the reason why all the villages form distinct communes, the largest not reaching 500 inhabitants. During the bad season from October to April, the villages, separated from each other by dangerous zones which cannot be crossed, are almost isolated from their nearest neighbors. Thus shut within itself, social activity has acquired an extraordinary intensity, which explains the importance, in this purely pastoral region, of the possession of low-lying meadows. It is this which regulates the usage of the pastures. In fact, in order to avoid the monopoly of the common property by a minority, the principle has been established of admitting to it only the cattle wintered with the hay crop of the country without the addition of other resources.

There is an exception to this rule only at Binn. Here the pastures are very extensive, the ground that can be cultivated or inhabited, on the other hand, very much restricted. The population, far from numerous, could not maintain itself alone as mistress of the valley; it has had to admit *consortages*[1] of cattle owners from outside the valley. The pasture grounds which it has reserved for itself are too vast for its own use,

[1] A Valaisian expression. The "bisses" or irrigating canals (see the illustration, Fig. 8, p. 59) belong to certain collective organizations also called "consortages." See the thesis by Louis Lehmann, *L'Irrigation en Valais, Étude de géographie humaine*, Paris, 1912.

and it has therefore been necessary to permit the introduction of cattle from without.

About the fifteenth century the building of a mule road over the passes of the Grimsel (7,241 feet) and of the Gries (8,097 feet), connecting upper Germany with the plain of the Po, opened up additional resources to the inhabitants of Conches. In the seventeenth and eighteenth centuries more than 200 horses and mules passed over the mountain every week. The building of the Simplon road in 1805 and the boring of the Saint Gotthard tunnel in 1882 ruined this transverse traffic and restored the preponderance to the longitudinal way along the *thalweg* of the Rhone. But the communications assured by the wagon road of Conches (built by sections from 1820 to 1867) are of an entirely new nature. This is a road frequented by tourists and marked by post relays. One of these, Fiesch, situated in the center of prosperous cultivation at the foot of a mountain famous for its view — the Eggishorn (9,626 feet) — being a starting-point for visitors to the Aletsch Glacier and the valley of Binn, has become the most densely populated village of the entire valley. Beside the ancient wooden houses, tall and narrow, the barns perched on piles, the haylofts and stables of an architecture which is found in all Haut-Valais, have risen hotels, bazaars, shops for rare minerals, etc., built of stone or boards with roofs of slate, roofing paper, or zinc. Most of the communes of the right bank of the Rhone have benefited from the same transformation. The advantages of a slope less steep, of a more prolonged sunlight, and of a greater security from avalanches have given way to the proximity of the wagon road at Blitzingen, at Selkingen, and at Ulrichen. On the other hand, on the left bank, which was left to one side, the decadence has been striking at Steinhaus, at Ernen, and especially at Ausserbinn, where it has taken on a strange form — an excessive dislike for marriage. In 1900, 81 per cent of the inhabitants of this little village were unmarried, though almost none of the inhabitants was younger than sixteen.

The influence of the highway is not limited to these changes in the relative importance of places in Conches. For a long time the valley of Conches, surrounded on all sides by high

mountains, remained almost absolutely closed to foreign importation. It enjoyed a sort of economic independence; it was almost sufficient unto itself, producing almost everything necessary to its inhabitants: milk, butter, cheese, meat, bread, vegetables, linen and woolen cloth, leather, wood, building stone, and even iron. This is no longer so; the cultivation of textile plants and even of cereals is diminishing under the effects of competition, while, on the other hand, the value of the cheese and cattle is increasing and the valley is on its way toward specialization in pastoral activity.

While this transformation is taking shape, without as yet the introduction of the methods of intensive cultivation, the peasant of Conches is already seriously departing from ancient usages; exploitation is becoming destructive. Not only are the peasants ceasing to keep up the upper pastures, to free them from the parasitic bushes of myrtle and rhododendrons, to gather and pile up the débris from landslides and avalanches, but they are depriving the mountain, to the profit of the plain, of the natural fertilizer left by the cattle which feed there, and they are admitting, along with the cattle, those great enemies of vegetation in the high pastures, sheep and goats. Thus the capacity of these pastures is diminishing, as is shown by a comparison of historical documents.[1]

Such is Conches, an interesting type of an alpine pastoral country, almost without nomadism, and of an economic oasis in process of absorption, that is, a region which is passing from one geographic form to another.

Let this significant example convince us how premature is every generalization about nomadism or even about the pastoral migrations of the Alps, until conscientious observers shall have studied in detail the infinite variety of these phenomena.

Here is another case, in the French Alps, of which the differences, and especially the striking analogies with the valley of Conches, give some suggestion of what might be the scientific import of a series of comparative studies methodically carried out.

This case is that of Queyras, a canton or "escarton" of

[1]See the documents carefully collected by Ch. Biermann, *op. cit.*

Briançonnais, which comprises the upper valleys of the Guil and its affluents.

> The existence of summer villages is hardly more than an accidental phenomenon caused by depopulation and the descent of the inhabitants toward the large villages of the valley. The upper Guil is not a country of chalets, if we take this term in the sense of *mayens* or of *stavoli*. We shall see that with all the more reason this is true of the valley of Molines. . . . . In this district, where, owing to the softer forms of the schists, wide valleys allow man to establish himself permanently at a great height, there is no need of villages especially intended for summer stopping-places. In the too distant parts and those that are distinctly too high for one to be able to pass the winter there, simple barns have been set up to shelter the supply of hay and to receive the animals in case of bad weather during their short stay in the neighborhood. . . . .[1]

While proposing a classification of the facts of human geography which would serve especially as a guide for direct observation, we are very careful always to place these facts back in their complex environment and to connect the phenomena which have first been arranged in series with the whole of which they form a part. Thus from the cultivated field and the herd we have been naturally led to consider the human establishment of the cultivators or of the drivers of the animals. We have met once more the phenomena of the house and the road in their connection with the facts of plant and animal conquest. All that we have said of the forms of semi-nomadism, all that will be said later on this subject in the chapter on the oases of the Suf and of the Mzab (chap. VI), and the explanations which we have sought for the restricted nomadism of the valley of Conches, as well as those of the intense nomadism of the Val d'Anniviers, show how these different surface facts are connected with each other.

There is a form of human agglomeration which is especially connected with the raising of herds — that regular but intermittent form called the fair. Men driving herds come together at certain dates related to the migration of the animals and occupy for some hours and in a very important manner a space which will be deserted all the rest of the year. Besides, in countries of an intense and varied economic life, where the

[1]Raoul Blanchard, "L'Habitation en Queyras," *La Géographie*, XIX, 1909, p. 44.

population is increasing, fairs pass through an evolution, just as does nomadism (we have noted it with reference to the Algerian steppe). Their recurrence is more frequent, they increase in number, the leading ones lose their supremacy, and the whole system becomes more regular. They are thus gradually transformed until they approach a type of center of exchange characteristic of the great cities — the daily market (such as the animal market of la Villette at Paris).

Thus this nomadic type of temporary human establishment, the fair, should be studied in connection with nomadism and semi-nomadism.[1]

[1]It goes without saying that there are other fairs which are not connected with cattle-raising, and which should belong only to the geography of circulation. In the same way, a series of allied facts should be connected only with the geography of circulation (see, for example, the little article which Paul Labbé has written on "Les Trains-foires en Russie," according to the *Bulletin officiel du Ministère des voies et communications* of Petrograd, in *La Géographie*, X, 1904, pp. 401–402). It is no longer by virtue of their names alone, but by reason of their intrinsic character, that the different economic facts ought to take their place in such or such a group of our positive classification.

CHAPTER V

THE ESSENTIAL FACTS OF HUMAN GEOGRAPHY
(Concluded)

THIRD GROUP: FACTS OF DESTRUCTIVE EXPLOITATION: PLANT AND ANIMAL DEVASTATION; MINERAL EXPLOITATION

1. *Modes of destructive exploitation.*
2. *A complex type of plant and animal devastation in the equatorial forest: the Fang.*
3. *The extractive industries from the geographic point of view.*
4. *The preëminent type of mineral exploitation on a large scale: the exploitation of coal.*

1. MODES OF DESTRUCTIVE EXPLOITATION

Under the general heading of destructive exploitation we group every exploitation that tends to make a levy on the world's raw materials, whether mineral, vegetable, or animal, with no thought or method of restitution. Men who take from a quarry, marble or stone for building houses, do so with no thought of returning the material naturally stored in the earth's crust. Fishing and hunting when not associated with any breeding, as of pheasants or salmon, likewise take from nature something for which no deliberate compensation is made.[1]

In man's first development of the earth, destructive exploitation is of primary importance. Even to-day many new countries are developed only through what we might call a combination of modes of destructive exploitation.[2]

[1]The art and tools of fishery, the distribution of the industry, and the nations or peoples that live by means of it are studied with more and more accuracy as oceanographic studies progress. A very abundant literature deals with such of these facts as refer to civilized countries. We are examining here, in its special relations with human activity, a characteristic type of primitive fishery (§2); but in accordance with the principle previously pointed out apropos of the sea (chap. II, §4), this special and extensive subject will be amply treated in another place.

[2]See Albert Métin, *Étude sur la colonisation du Canada, La Colombie britannique*, Armand Colin, Paris, 1907.

Among the different forms of destructive exploitation we shall find that some have a normal and methodic quality while others show an unrestrained intensity that makes them well deserve the German name of *Raubwirtschaft*—that is, economic plunder, or, more simply, devastation.

Destructive exploitation, *Raubwirtschaft*, is, in a sense, a particular form of gathering or harvesting, *Sammelwirtschaft*, but it attacks nature with much more violence. This violent attack may end in want (*Not*), and we then have *characterisierte Raubwirtschaft*, characteristic devastation.[1]

Destructive Exploitation by Civilized Peoples

It seems particularly strange that characteristic devastation with all its grave consequences should especially accompany civilization, while primitive folk know only milder forms of it. They do indeed partially despoil and destroy, but they hardly ever devastate, in the true sense of the word, and they do not have to suffer the want that is the usual result of devastation.

We take as examples two widely contrasted cases. On the one hand, cannibals use their economic resources with a certain forethought by limiting hunting, or by declaring "taboo" for a time certain animals whose number tends to diminish.[2] On the other hand, we have the more highly developed Incas of Peru, who adopted very strict measures to prevent the exhaustion of the precious guano, while the birds were carefully watched and protected. Hunting, the privilege of the Inca alone, was allowed only on certain holidays, and the killing of the female wild guanaco and vicuña was strictly forbidden. The death penalty was inflicted on violators of these laws.

We are well aware that elsewhere examples are cited of savage peoples who cause devastation by burning forests and

[1]For a review of the study on *Raubwirtschaft*, published by Ernst Friedrich in the geographic review of Gotha, see the article by A. Wahl, in *La Géographie* (X, October 15, 1904, pp. 247–254). This review has been the chief reference for facts on the subject, supplemented by numerous observations and developments.

[2]On the subject of "primitives," consult the work by Élisée Reclus, *Les Primitifs, Études d'ethnologie comparée*, Schleicher, Paris, 1903; these studies, published ten years ago, were written almost thirty years ago, but they are still full of interest, perhaps because of their excess of indulgent optimism with regard to all those human groups which have not yet been contaminated by civilization. In the last great work by Élisée Reclus, *L'Homme et la terre*, will be recognized general tendencies of a like nature.

cultivating the land thus acquired until it is exhausted.[1] But, since in such countries there is still an abundance of unoccupied land, this process does not result for the inhabitants in a dearth of the means of existence; it merely brings about a nomadic form of existence. Nor, among savage peoples, does hunting have the character of destructive exploitation in the proper sense; it is not so intensive that it is not balanced by the reproductive power of nature.

In short, characteristic devastation with all its consequences is almost a peculiarity of civilized peoples. And how far-reaching these consequences are! Plants and animals are removed from the possibility of scientific investigation, and the extinction of a species may cause regrettable gaps in our knowledge.[2] A warfare of extermination is carried on against certain animals that are considered injurious, when more profound observation would show that they were useful. The case of the moles and alligators is an excellent illustration.

Two points are to be noted. First, devastation always brings about, not a catastrophe, but a series of catastrophes, for in nature things are dependent one upon the other. In the second place, devastation in all its forms is a phenomenon not of fixed, but of floating, humanity, and is associated with such facts as the nomadic life, colonization, or war.

The Principal Groups of Facts of Destructive Exploitation

The mineral kingdom.— The exploitation of mines (*Bergbau*) is always a form of destructive exploitation in the sense that it is impossible to replace the materials that are taken from the earth. However, under the name of devastating exploitation, *Raubbau*, we should include only abusive exploitation, where

[1] Cultivation by burning the vegetation on a stretch of ground and then sprinkling the ashes over it. (See, in particular, the example of the Fang, given farther on.)

[2] Might one not say that, from this purely scientific point of view, the cremation of the human body is a very regrettable form of destructive economy? What would be our knowledge of the beginnings of life and human civilization on the earth if we had not had at our disposition skulls, skeletons, and tombs? For example, Eugène Pittard, who has begun, with a very fine first volume, a series entitled *Crania helvetica* (I, *Les Crânes valaisans de la vallée du Rhône*, Geneva and Paris, 1909–1910), writes: "We have given ourselves the ungrateful task of studying the ossuaries still to be found in the canton of Valais. The pious custom of thus building sanctuaries to the dead —a survival of the Neolithic customs— has preserved considerable quantities of scientific documents which, had it not been for this, would have been irremediably lost" (p. 6). There is not an anthropologist worthy of the name who does not think likewise.

the desire for immediate returns causes it to extend over too wide a surface, and where the surface only is exploited, to the detriment of future generations. As an example take the superficial, hasty, and wretched exploitation of the silver deposits in the south of Spain. The consequences of this devastation in exploitation show themselves clearly only where the material extracted is distributed over the earth in restricted spots and in relatively small quantities. Thus guano was locally exhausted in some dozens of years, and it will be somewhat the same with the nitrate of Chile. At the present moment an improper exploitation of coal is going on. In spite of the enormous quantity of this precious fuel, the time will come when it will be exhausted, at least locally. Devastation in the exploitation of coal has its geographical distribution. It is striking to find that the zone comprised between 36° and 56° N. latitude, where the most advanced civilization is concentrated, is also the zone where this *Raubwirtschaft* is intensely practiced.

We may also speak of devastation in our resources of petroleum, phosphates, diamonds, precious metals, etc.; but, on the other hand, there can hardly be a question of devastation in the case of metals such as iron, for iron ores seem to occur in nature in quantities that are relatively inexhaustible and that are easy to reach.

Devastation is of the worst sort if, as a result of inconsiderate exploitation of mines, catastrophes take place such as the sinking of Eisenach and of Brux, or if along coasts the rocks which protect the land from the attacks of the sea are removed, as on the shores of the Baltic Sea.

However much devastation is to be condemned, it sometimes has a happy result. With the exhaustion of the mines comes poverty, and large groups of people, if they do not wish to emigrate, find themselves forced to turn to more permanent occupations, as was the case in the Erzgebirge.[1] In California the discovery of gold in 1849 led to a gold rush of great intensity. To-day the resources of soil and forests are far greater in significance than the mineral products, and California has grown

[1] Friedrich returns often to this idea, which we consider by far too optimistic—the belief that *Raubwirtschaft* is only a stage and that it is necessarily followed by a progress.

from a beginning as a mining center into one of the significant states of the Union.

The plant kingdom.— Still better known perhaps than mining devastation is the *Raubwirtschaft* of cultivation. It attacks the fertility of the soil, greedily taking plant foods from it without replacing them, desiring to obtain a crop at the least possible expense, in spite of the fact that man has at his disposal the means of restoring the richness of the soil.

In western Europe, with its very dense population and its very intensive cultivation, devastation is practically no longer found; necessity has taught the value of fertilizers. In colonial countries this is not the case. There the cultivator, although a European, finds himself, so to speak, in the condition of savage peoples, and like them he begins to exploit. He practices one-crop farming at least as long as the population is thin, and he exhausts superficially one region after another; finally the exhaustion of the land makes itself felt and he is then compelled to practice crop rotation or to use fertilizers. Here again devastation leads to progress.

Devastation in young colonial countries causes, however, a lack of balance in world production, and producers who exploit their land normally cannot rival their competitors in colonial countries. This, in a broad sense, is the situation of Europe with reference to the colonies,[1] accentuated by the growing production of countries like Russia, which is passing from an inferior social condition to a higher type of civilization and can still produce more cheaply than its rivals.

How many producers of wheat practice *Raubwirtschaft*, especially in the temperate zones, in the United States, Canada, Russia, Siberia, the Argentine — regions that are at the same time seats of a higher civilization! In the Dakotas, Nebraska, and Minnesota the consequences of devastation are being keenly felt, and a change is taking place in the method of exploitation; in other words, progress is a necessity.

The peoples who are semicivilized (at least according to our ideas) seem to be distinguished from the peoples of a higher civilization by the fact that they do not practice

[1]See Marcel Dubois, *Systèmes coloniaux et peuples colonisateurs*, Masson and Plon, Paris, 1895. With his customary independence of mind, the author shows clearly all that ought to be included under the heading of facts of colonization.

devastation; as a result they do not have to suffer its consequences. But have not the Chinese reached their careful cultivation through devastation? On the one hand are the deforested, soilless mountains of Chïli where once there were cultivated fields; on the other hand are the rich hillside farms of Shensi where a similar fate is averted only through patience and scientific forethought.[1]

Civilized man carries on his devastating activity particularly in forested regions. The forest is a treasure which, wherever it is protected, has been growing richer year by year for centuries. Carefully exploited it produces annually and accumulates true riches which can be utilized at the proper time. We know the beneficent influence of the forest upon agriculture, and the hygienic and biological part it plays. We know that it is the best protector of mountain peoples against avalanches and inundations. And yet the treasure is badly administered. The devastation practiced by the Venetians, who in the Middle Ages deforested the coast regions of the Adriatic,[2] can be excused; but to-day, when we know all the dangers which unrestrained deforestation brings with it, the guilt of the highlander who fells trees for the sake of an insignificant gain is unpardonable.[3]

If savages devastate by making clearings for cultivation in

[1] F. H. King, *Farmers of Forty Centuries;* Ellen Churchill Semple, "Influence of Geographical Conditions upon Japanese Agriculture," *Geog. Jour.*, XL, 1912, pp. 589–607; "Japanese Colonial Methods," *Bull. Amer. Geog. Soc.*, XLV, 1913, pp. 255–275.

[2] "European Countries Reclaim Waste Land," *Forest Service Bull.*, December 12, 1912, p. 2. The Karst was a stretch of barren limestone lands comprising some 600,000 acres in the hilly country along the Austrian shores of the Adriatic Sea. For centuries it had furnished the ship timber and other wood supplies of Venice, but excessive cutting, together with burning and pasturing, left it a waste almost beyond recovery. In 1865 the government began to offer help to landowners who would undertake forest planting there. Taxes were remitted for a period of years, technical advice was given, and plant material as well as money was supplied. At present over 400,000 acres, or two-thirds of the Karst, are under forest, partly as a result of planting.

[3] In spite of the distressing consequences which follow the devastation of forests, deforestation continues in Roumania, in Abyssinia, in Sumatra, in Siberia, and in the United States as in Australia, and, in this regard, our time really deserves the terrible name of the *age of extermination.* A quarter of a century ago Sir Joseph Hooker said, on the subject of the beautiful forests of sequoias in California: "The doom of these noble groves is sealed. No less than five saw mills have recently been established in the most luxurious of them, and one of these mills alone cut in 1875 two million feet of Big-tree timber; and a company was lately formed to cut another grove. In the operations of the California wood-cutters, the waste is prodigious. The young, manageable trees are first felled; after which the forest is fired to clear the ground and get the others out, and then the saplings are destroyed. More destructive still are the operations of the sheep-farmers, who fire the herbage to improve the grazing, and whose flock of tens of thousands of sheep devour every green thing, and more effectually than the locust. The devastation of the California forest is proceeding at a rate which is utterly incredible, except to an eyewitness. It is true that a few of the most insignificant groves of the Big-trees at the northern extremity of its range

the virgin forests, these clearings are small, scattered, soon abandoned, and quickly disappear (see the example of the Fang). The devastation is restricted to the shores of the sea and to the lower slopes and floors of valleys; but, with the progress of colonization and the improvement in means of communication, devastation will not be long in attacking regions now inaccessible. The forest has always had less strength in countries with a dry climate than in well-watered countries; thus in dry countries the forest has been easily ruined. The progress of devastation is still more rapid in the steppes.

In all climates, islands above all other lands have been affected by devastation: Ceylon, Mauritius, Réunion, Saint Helena, some of the Bahamas, and most of the islands of the Mediterranean are deforested.[1]

The main field of forest devastation is the north temperate zone, a region inhabited by the civilized white race. Forest devastation is essentially the work of civilization — that is, of a denser population and of more perfect tools (Ratzel).

We keep warm with coal or coke; we build more and more with iron, brick, and concrete; the locomotives of southern Russia, of Mexico, and in sections of the southwest United States burn petroleum. In short, new products are everywhere replacing wood so that it no longer seems to be the indispensable product that it was for long centuries. However, let us not deceive ourselves, for this current idea is a grave error. Wood is more than ever indispensable to the modern industrial

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are protected by the state legislature and that a law has been enacted forbidding the felling of trees over fifteen feet in diameter; but there is no law to prevent the cutting or burning of the saplings, on which the perpetuation of the grove depends, or the cutting or burning of the old trees, which, if they do escape the fire, will succumb to the drought which the sweeping away of the environing forest will occasion.

"During the last quarter of a century the Anglo-Saxon has been ruthlessly carrying fire and the saw into the forests of California destroying what he could not use, and sparing neither young nor old, and before a century is out the two Sequoias may be known only as herbarium specimens and garden ornaments; indeed, with regard to the Big-tree, the noblest of the noble coniferous race, the present generation, which has actually witnessed its discovery, may live to say of it, that 'the place which knew it, shall know it no more.'" (From an address before the Royal Institution of Great Britain, delivered April 12, 1878, by Sir Joseph Dalton Hooker, and published in the collection of Botanical Papers of Sir J. D. Hooker.) Fortunately some of the best groves are now protected in national forest reserves. R. Ducamp, ("La Marche retrograde de la végétation," *Rev. des eaux et forêts*, XLVII, 4th series, 6th year, 1908, pp. 289–298) describes the progressive "deforestation" of tropical countries like English India and Tonkin.

[1]At Messina in 1902 G. Ricchieri made a very exact study of the ancient extent of forests in Sicily and of the progressive march of deforestation (*Quali insegnamenti si possono trarre dai desastri di Modica*, Mantua, 1903).

world. The timber used in mines, for railroad ties and cars, posts for telegraph, telephone, and electric power wires, paving blocks, pulp for making paper, etc. — all the great lines of economic activity, from the exploitation of coal to the development of newspapers — imply an increasing consumption of wood. Never in the history of humanity has there been a more reasonable and also a more eager demand for trees.

In primitive times and in primitive countries the willful burning of forests destroys in a few days vast stretches of timber. But in such times and countries wood is protected from exploitation up to a certain point by the fact that it is heavy and difficult to transport. The expense of transportation is such that wood carried on the backs of mules can hardly go beyond 12 miles (20 kilometers), and upon wheels hardly beyond 24 miles (40 kilometers), without doubling the cost.

To-day, owing to the many means of transportation employed, from the most ancient, such as floating, to the most modern, wood is brought from all directions to the great industrial markets. That is why the past century has been such a spendthrift in forest riches. Here are some significant figures.[1]

PERCENTAGE OF FOREST

The proportion of the total surface that is still wooded

	MÉLARD (1900) Per cent	DECOPPET (1910) Per cent		MÉLARD (1900) Per cent	DECOPPET (1910) Per cent
Great Britain	4	....	Switzerland	20	21.9
Denmark	6.2	....	Norway	21	21
Netherlands	7.5	....	Germany	23.3	25.9
Spain	13	16.9	United States	25	....
Greece	13	....	Austria-Hungary	30	30
Italy	14	14.6	Russia	32	37
Roumania	14	....	Canada	38	....
Belgium	17.2	17.7	Sweden	40	47.6
France	17.7	18.2	Finland	60	....

Fortunately some countries still constitute valuable reserves (Finland, Sweden, and Canada), but account must be taken of the enormous and constantly increasing consumption by the great industrial countries.

[1] The data of these tables are borrowed from the interesting work which A. Mélard, inspector of waters and forests, prepared for the Paris Exposition of 1900, *Insuffisance de la production des bois d'œuvre dans le monde*, and from the more recent estimates of the Swiss Bureau fédéral de statistique forestière, which is under the direction of Professor Decoppet of Zürich. We thus obtain data for comparison separated by an interval of about ten years (1900 and 1910).

From all sides come the echoes of catastrophes which occur in regions that are to-day stripped of their wood—inundations on the slopes of the Alps, the Pyrenees, and the Appalachians, gullying of the Russian plains, etc. And the lamentations are so strong and so well justified that, in all civilized countries, not only is the question of reforestation constantly discussed, but the work has already begun.[1] While the remedy is being applied, the evil continues. Exploitation is allowed to develop without method and devastation to continue without oversight; everywhere the axe continues to lay low the century-old trunks which it will take new centuries to replace. This progressive impoverishment of the earth in the matter of trees is one of the most important economic facts of the present time. Without hindering the attempts at reforestation, measures should be taken to end at once the mad and selfish depletion of the forests wherever they still exist.[2]

When the trees no longer form a protective covering for the earth, the trickling and running waters are no longer beneficent but destructive agents. They help to denude the surface still more by carrying away the soil or depriving it of its covering of humus. Vast spaces, once covered with splendid forests, are to-day only stretches of bare and arid rock. Not only does the water no longer play its helpful, fertilizing rôle, but almost as soon as it has fallen it disappears into the earth through the fissures in the rocks. In limestone countries it forms those subterranean streams which hollow out caverns. Some of this underground circulation may evoke the admiration of the tourist, but it can only sadden the economist to see this agent of all fertility and of all life lost far from the cultivable and habitable surface.

Where the European can establish himself for any length of time he starts trading-posts around which plant exploitation (*Pflanzenkolonien*) gradually develops. He seeks the raw material from the savage, and at the beginning of colonization the natives procure these products without much difficulty by

[1]See, Charles Rabot, "La Dégradation des Pyrénées et l'influence de la forêt sur le régime des cours d'eau," *La Géographie*, XVI, 1907, pp. 163–170; and for Russia, Woeikof, *Second congrès du sud-ouest navigable*, Toulouse, 1904, pp. 470–478.

[2]Bernard Brunhes has especially emphasized this consideration (see pp. 348–350).

simply "gathering" them. Urged on by the prices offered, they are not long in reaching devastation. Of course in time cultivation will be started which will yield a regular product, but in the meantime incalculable natural wealth, which might be conserved for lasting use, is entirely disappearing.

In tropical countries devastation makes its worst attack upon rubber, gutta-percha, and the *Raphia vinifera*, the young leaves of which the natives gather without restraint although there is an increasing industrial demand for the inner bark. We might point out abusive exploitation of many other products of the plant kingdom, such as esparto grass (an African plant) and sandalwood.

Among these plants we shall take the clear and simple example of that group which produces the precious latex, from which rubber is made and for which there is an ever-growing industrial demand. To-day, in all the European equatorial colonies, an attempt is being made to develop cultivated rubber, although until now rubber has been obtained chiefly by "gathering" from wild plants.

But who could estimate the value of the forested stretches of Africa or America that have been thus "devastated"? Here are some official figures for the Belgian Congo, one of the regions of the globe from which we have obtained rubber in the largest quantity:

PROGRESS IN EXPORTATION OF RUBBER IN 14 YEARS (1891–1904)

Years	Weight in Thousands of Pounds	Value in Millions of Dollars
1891.....	10,628.2	0.63
1892.....	365.2	0.121
1893.....	530.2	0.186
1894.....	743.6	0.270
1895.....	1,267.2	0.540
1896.....	2,897.4	1.254
1897.....	3,656.4	1.602
1898.....	4,648.6	3.049
1899.....	8,241.2	5.404
1900.....	11,695.2	7.720
1901.....	13,248.4	8.685
1902.....	11,770.0	7.913
1903.....	13,019.6	9.071
1904.....	10,628.2	8.299

Although in this last series of cases it is the uncivilized natives who, with no thought of the morrow and failing to understand

that a well-conducted exploitation might mean for them a lasting income, practice devastation and "cut off the branch upon which they sit," it is certainly the Europeans who are really responsible because, wishing to grow rich quickly, they furnish tools to the natives and encourage unwise exploitation; indeed they sometimes by torture and slave-driving methods force the laborers to work (Congo, Amazon).

We have just seen how the rubber industry, in so far as it is independent of cultivation, depends upon forms of destructive exploitation. It had its birth from them, is suffering the consequences of them, and for a long time to come will be their vassal.[1] Human geography must always approach the more complex problems by way of the original problems that condition them, and in analyzing the former must never lose sight of the latter.

This primary idea of localization of certain modes of industrial activity must govern the study of industrial facts even in regions where life is more complex and more diversified.

The entire wood industry, established at so many points in that great boreal forest of which we have already spoken at length in connection with the habitation, is logically and geographically associated with the vast and general fact of forest devastation; and, on a small as well as a large scale, in a limited district of Switzerland as in a vast country like Sweden, the distribution of the elementary industries is at the same time the expression of the more or less perfected and concentrated industrial methods and of the general phenomenon of destructive exploitation.

The animal kingdom. —Devastation makes its ravages also in the animal kingdom. Man may kill animals for food or clothing, but if he takes care to provide for their reproduction, it is called *raising*, not *devastation*. Nor is it *Raubwirtschaft* when, as a result of the increase of population in Europe or in other densely populated regions, men find themselves

[1] "The geography of rubber changes very rapidly. On the one hand, some forested regions become exhausted while new ones are brought to a state of production; on the other hand, the plantations are unceasingly extending" (L. Perruchot, "La Deuxième Exposition internationale du caoutchouc," *La Géographie*, XXV, 1912, p. 200; read the entire article, pp. 193–200, which sums up well the geographic physiognomy of the present exploitation of rubber). See also the *Rev. écon. internat.*, February 15–20, 1912, a number especially devoted to rubber (articles by Em. Perrot, E. de Wildeman, P. von Romburgh, E. Lejeune, Vincent, Herbert Wright, and G. Lamy-Torrillon).

restricting the sphere of animals. That is an entirely natural fact. Man has also a right to exterminate dangerous animals.

But the question becomes somewhat different when we consider hunting as a sport (see Fig. 137, p. 342). Hunting becomes devastation if it attacks without consideration the animals that are not injurious.

In the beginning hunting, like the clearing of the forest, was a condition of colonization, but, like the clearing of the forest, it too often becomes devastation. In France, 74,130,000 acres (30,000,000 hectares) out of 110,000,000 acres which constitute the "hunting region," are given over to "mercenary hunting, which should be considered a veritable evil."[1]

Raubwirtschaft in the animal kingdom is practiced especially for the purpose of adornment, particularly feminine adornment (feathers, aigrettes). Among the favorite birds is the silver heron. In Florida about a million and a half of these useful insect-eating birds are slain every year. Small wonder that their number is rapidly decreasing and extinction is imminent. Millions of birds of paradise and humming-birds are killed each year.[2]

The birds of passage have also excited the cupidity of men, and, in recent times especially, there has been a complaint of their extermination in southern Europe. One is inclined to attribute the increase in grasshoppers in certain regions of Africa to the decrease in the number of birds that eat them. In the United States the innumerable swarms of migrating pigeons, once migrating in flocks so extensive and dense as to darken the sun, have disappeared, although in the neighborhood of Petoskey, Michigan, their nests used to cover nearly 100,000 acres (40,000 hectares).

In the two departments of Landes and Basses-Pyrénées, going along the shore at the time of the migration of the birds, one may count at least one double net every five hundred yards, and that too over a space several miles in width. In one good day each net-owner catches from fifty to sixty dozens of small birds, and sometimes more. This means then, with a minimum of a thousand

[1]Quoted from Maurice Lair, "L'Importance économique de la chasse en France," *Rev. écon. internat.*, September 15–20, 1909, pp. 399–424.

[2]On the destruction of bird and animal species, see the excellent pages in Élisée Reclus, *L'Homme et la terre*, VI, pp. 225 ff.; also W. T. Hornaday, *Our Vanishing Wild Life: Its Dissemination and Preservation*, New York, 1913.

FIG. 137. ANIMAL LIFE IN THE FOREST. A CLEARING IN THE GREAT FOREST OF EASTERN EUROPE (RUSSIAN POLAND)

hunters, from fifty to sixty thousand dozens of birds per day. But let us take a daily average of twenty-five thousand dozen for the thirty days in which the passage ordinarily lasts, and we have *nine millions* of small birds destroyed each year in two departments alone.[1]

The ravages of animal devastation are carried on especially on the confines of the boreal forest, both in the north and in the south. In Canada, in the northern part of the United States, in the north of Russia, and in Siberia, fur-bearing animals are hunted in large numbers, and in the southern part of this zone devastation is almost an accomplished fact. The beaver, first sought for its flesh and then for its fur, has almost completely disappeared. In America millions of bison were slain in ten years.[2] The reproductive force of nature is powerless against such sanguinary instincts and there is no safety for the persecuted animals save in flight to inaccessible places.

Of all the animals living in the virgin tropical forests and the savannas, the elephant is most threatened because of its ivory. It is already very rare in the savannas; in the forests of central Africa the hour of its complete disappearance will come with the establishment of better means of communication.

EXPORTATION OF IVORY FROM BELGIAN CONGO FROM 1891 TO 1904

Years	Weight in Thousands of Pounds	Value in Millions of Dollars
1891.....	310.85	0.540
1892.....	410.05	0.714
1893.....	407.85	0.714
1894.....	557.76	0.965
1895.....	643.74	1.119
1896.....	421.08	0.733
1897.....	542.33	0.946
1898.....	473.99	0.830
1899.....	641.54	1.119
1900.....	577.60	1.004
1901.....	438.71	0.753
1902.....	548.94	0.946
1903.....	407.85	0.714
1904.....	368.17	0.733

In the steppes the ostrich is more persecuted than any other game, and its only defense is in the vast, open, and inhospitable nature of its home. In 1858 it had already disappeared

[1]Letter quoted by Cunisset-Carnot in the *Temps*. Swallows, see also the *Temps*, July 5, 1910.

[2]In the year 1878–1879, 200,000 buffalo skins were shipped down the Missouri. In 1892 the Hudson Bay Company's warehouse at Montreal received 133,814 skins.

from the high Algerian plateaus, and in South Africa, where it was once plentiful, hunters such as Anderson and Carew carried on a veritable war of extermination against it, so that it became very rare. This very scarcity brought progress. In 1860 people began to devote themselves to the raising of the ostrich and with such success that in 1895 the number of domesticated ostriches was estimated at about 200,000.

The extinction of an animal species takes place most rapidly within limited spaces, especially in islands of small extent. England has outstripped the Continent in the extermination of the bear, the lynx, the deer, the elk, the beaver; in the island of Réunion the giant bird *Didus ineptus* was exterminated in less than ten years.

The devastation of the animal kingdom is most disastrous in the seas, where it is favored by the competition of the nations. Take, for instance, the slaughter of seals,[1] of tortoises,[2] and of whales.[3] It is especially in the Arctic seas where the great marine mammifers are particularly numerous, that devastation is unrestrained. It not only causes the impoverishment of the marine fauna, but also the withdrawal toward the south of those peoples of the north who live upon the fat and flesh of these animals.

Everywhere fishing has a tendency to cause extermination.[4]

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[1]See Isaiah Bowman's "Alaska Notes," *Nat. Geog. Mag.*; also D. S. Jordan, *Fur Seals and Fur Seal Islands of the North Pacific Ocean*, in 5 parts, Special Agents' Division, Treasury Dept., Washington, 1898.

[2]Wieland, "Marine Vertebrates," *Popular Science Monthly*.

[3]The maximum size of the whale fleet in 1846, was 680 ships; in 1914, 32 ships. Maximum production in 1851 was 428,074 barrels of oil, 5,652,300 lbs. of bone; in 1914, it was 19,270 barrels of oil, 34,000 lbs. of bone; (*Whalemen's Shipping List*, printed 1843–1914, *Department and Consul Report*, 5542, 1915.) See also Tower, *History of the Whale Industry*.

[4]See the article by Hugh M. Smith, "King Herring: An Account of the World's Most Valuable Fish; Industries It Supports, and the Part It Has Played in History," *Nat. Geog. Mag.*, Washington, XX, 1909, No. 8, pp. 701–735 and 22 illustrations. See also an excellent article by Charles Rabot, with some typical figures, "Meurtrière conquête d'un aliment vulgaire," *Lectures pour tous*, 1901, pp. 323–332. "In the north of Europe, cod serves all purposes. It feeds men and domestic animals. In the winter, in place of hay, codfish heads dried and then boiled are given to the horned animals. For several years codfish heads that were not used to feed stock have in Germany been made into a powder for fattening pigs" (p. 329). Charles Rabot, in his book *Aux Fjords de Norvège et aux forêts de Suède*, says again: "Fisheries are the chief industry of western Norway, and the cod and the herring the two great sources of revenue for this region. In this country, composed entirely of high, barren mountains, man could not live without the inexhaustible fertility of the ocean. Here it is the sea that feeds man" (p. 137). See Fig. 138, p. 345. For a good monograph on all the questions connected with fishing and one in which the subject is treated in a spirit truly scientific, see *Le Léman*, by F. A. Forel, III, pp. 603–659.

Even in rivers and lakes where trouble is taken to assure restocking, fishing is a menace. In the Lake of Neuchâtel fishing is carried on to such an extent (only by nets and other

FIG. 138. DRYING OF COD IN NORWAY

instruments that are within the law) that its impoverishment becomes pronounced and the government of the canton is compelled to take new measures to protect the fish.

Finally there is a devastation which touches man and either injures him or removes him completely from his environment.

Natural refuges, places that facilitate attack or flight, contrasts of poverty and comfort, have ever been a cause of devastation in a violent or mitigated form. Thus oases attract nomads who are conscious of their strength and who feel their superiority to the peaceful possessors of these privileged spots. A necessary consequence of this is the withdrawal of agriculture and the encroachment of the desert upon regions once cultivated.[1]

Seas rich in islands, mountains, and impassable forests have likewise always favored devastation in the form of piracy or brigandage. War forms a chapter of *Raubwirtschaft* which, geographically, should have a place here; it is the great and terrible struggle for space and life.

[1]Ratzel, in *Anthropogeographie*, has a fine chapter on the geography of ruins. E. W. Hilgard states that the most ancient and flourishing centers of civilization grew up in arid countries conquered by means of irrigation: "The sun and the climate of these regions have not changed, but the bad political situation, the consequence of nomadic invasions, has paralyzed agricultural and social development" (E. W. Hilgard, "Why Ancient Civilizations Flourished in Arid Regions," *North Amer. Rev.*, Sept. 1902, p. 315).

The most hideous form of devastation among men is the slave trade. European colonization developed this trade on a large scale by transplanting the unfortunate blacks from one continent to another. Colonization has too often affected the "savage," not only in his liberty but in his very existence, either by destroying his food resources or by bringing in poisons, such as alcohol of the poorest quality. It is a fact found to be universally true that non-civilized peoples gradually die out when brought into contact with our civilization.

The extermination of the natives has made the most rapid progress in regions where the climate is favorable to European colonists — North America, the Argentine, South Africa, Australia. One might perhaps offer in the way of explanation (although not of excuse) that, as a result of their very increase, the Europeans were obliged to extend the limits of their territory. But how justify the slow extermination of the "savages" in regions uninhabitable for any European?

A last form of devastation is cannibalism, which to-day is confined almost exclusively to tropical regions.

The Present Reaction against Destructive Exploitation

In recent times much attention has been given to destructive excesses. In Europe and the United States the point has been reached where energetic measures are being taken against devastation.

The United States first set the example of establishing "national parks," which are veritable "museums" of plant and animal life as well as of natural riches.

Thus the United States has the Yellowstone National Park, the Yosemite National Park, Mount Rainier National Park, Sequoia (Big Tree) Park at the foot of Mount Whitney, Glacier National Park, and several others. Canada has the Laurentides National Park, Algonquin Park, Banff Park in the Rockies, and has just reserved along the Grand Trunk Railway a park of 5,000 square miles (13,000 square kilometers) or twice the extent of the average French department (Jasper Forest Park). The Argentine has had a study made of the projects of parks of the Iguassu Falls and of the Lake Nahuel Huapi districts. At the present time the movement is

gaining ground in Europe. There already exists an institution of the sort at Stockholm, under the name of Skansen, but it is of very small dimensions and of a different character; for the Swedes have brought together at Skansen all the natural or human facts that seemed to them worthy of preservation and have created a park of an artificial character and particularly of historic interest. Together with animals and plants of the country, one sees ancient types of houses; local songs are sung and old provincial dances are reproduced. The movement which is beginning to make itself felt in Germany, in Switzerland, in Austria, in France, resembles much more closely the American examples. In Germany the acquisition and establishment, as a natural reserve, of one of the most mountainous and picturesque districts of the country, the forest and lake district around the little lake of Königssee, in the principality of Berchtesgaden, on the confines of the Salzburg, is due to a private society, the Naturschutzpark of Stuttgart. This mountainous canton, considering its moderate altitude (6,000 to 6,500 feet), is still almost in virgin condition; it contains a large number of rare plants—which it is proposed to protect,—great woods, rocky pastures frequented by a considerable number of chamois and by other game. It appears that the owner gave up territory covering some 37,000 acres (15,000 hectares) on a ninety-nine-year lease. In another direction the Naturschutzpark Society has just obtained control by purchase of a vast natural region of the Lüneburger Heide, the picturesque beauty of which was beginning to be recognized and to attract crowds of tourists at the same time that the landscape was threatened by the progress of the exploitation of petroleum and potash salts. Mount Wilseder, 561 feet (171 meters) high, about 24 miles (40 kilometers) south of Hamburg, with the immediately surrounding country (533 acres in all), will form the nucleus of the future national park. All about are moors and state forests abounding in large game, and it is hoped that the size of the park may easily be increased to from 7 to 10 square miles (three or four square leagues).

In Switzerland the Naturschutzkommission of the Helvetian Society of Natural Sciences leased, on December 31, 1909, from

the commune of Zernez (Engadine) for a period of twenty-five years, the Val Cluoza, which since January 5, 1910, has formed the first section of the "national park." The Swiss Confederation has decided to take upon itself the formation of this reserved domain while the *Ligue suisse pour la protection de la nature* will at its own expense assure the maintenance and care of the national park.

Special laws have been passed to protect fish and game. In order to prevent the disappearance of the white bear and the blue fox, islands have been reserved for them in Alaska.[1] In Switzerland there has long been a certain number of regions in the high mountains that are hunting reserves, particularly refuges for the chamois. In France, England, Germany, and elsewhere women are forming associations to protect the birds, and men are endeavoring to save the African elephant from absolute destruction.[2]

As the effects of devastation make themselves felt more and more, we notice, at least among Europeans, a certain solicitude for everything that is in danger of disappearing. In England and Germany thought is being given to the measures that may be employed to stop devastation in the exploitation of mines, etc. This solicitude has been shown particularly with reference to the forests. The association between forest and water and the need of defending one's self against floods and of using streams for power have brought our contemporaries to a better understanding of the urgent necessity for safeguarding these two sources of wealth which are rapidly disappearing.

In our day, as we have said, in all fields of rural and industrial economy, we hear much about utilizing the sovereign energy of water. Everywhere cultivation is dependent upon rain and reserves of water. In the Far West of America and in the Argentine Republic, in the south and north of Africa (in Egypt or in southern Algeria), in India and Russian Turkestan, in all latitudes and in both hemispheres, men are eagerly and patiently toiling in this conquest of the desert through a

[1] "L'Élevage du renard bleu," by Henri de Varigny in the *Temps*, January 24, 1907, after a study by Th. E. Hofer appearing in *Forest and Stream* (July 28, 1906.)

[2] See a short summarizing note by Fr. Hahn, "Tierschutz in Afrika," *Petermanns Mitt.*, LVI, 1910, pp. 141-142, with a plate of four drawings (Plate 27): "Tier-Reservationen in Britisch-Afrika."

methodical distribution of water. Finally, it must be repeated here apropos of the forest: "White coal" is to-day and will be still more to-morrow the most important reserve of energy that man can use in his industrial activity. Water is more than ever necessary to us, and it is more than ever escaping from us. Trees and water depend upon each other, and both are going to fail us through the fault of our own deeds. A reaction is inevitable.

It is in Switzerland that the nations of the Old World must to-day seek the most perfect expression of a reaction against the right to abuse the soil. The federal law of October 11, 1902, on the protection of the land in forested and pastoral regions, is certainly the most coercive type of legislation in the world, but it is also the most effective for the preservation of mountain soils.

Switzerland in 1838 gave another example of wise foresight in a political conflict of pastoral origin which led to a struggle between the partisans of large and small pasture animals, the *Hornmänner* and the *Klauenmänner*. The federal council settled the strife to the advantage of the partisans of cattle. It withdrew the mountains from the systematic devastation of the sheep and goats and gave the impulse to the exploitation of cattle which assures the preservation of the soil and the fortune of the country.

In all the countries where forest plundering is practiced, men are struggling and must struggle more and more, against this form of destructive exploitation.

Thus a public opinion is being created in all civilized countries which is a deliberate reaction against the excesses of destructive exploitation. The scientific book which best sums up all these new tendencies is *La Dégradation de l'énergie* by Bernard Brunhes:

Ostwald has said that civilization consists in the art of making use of the brute energy of nature. The arms successively invented by man represent successive stages in the utilization of the ordinary forms of energy: weapons for striking, which use the kinetic energy of matter, were followed by weapons which were thrown by means of the potential energy of a tightened spring, and then by the firearm, which uses the chemical energy contained in a powder. But all the progress of civilization is not equally marked. If man's action is always limited by the impossibility of making the world go backward, he has the power of slowing up or increasing degradation. Industry, which is beneficent when it slows up the degradation of energy, is evil when it increases it and when it causes the devastation of nature (*Raubwirtschaft*).

The part assigned to living beings is to retard the degradation of energy in the world. Consciously or unconsciously they play this part fairly well. The man who harnesses "natural forces" plays it especially well; the man who makes use of a waterfall to turn his waterwheel diverts a useless caloric energy into the form of mechanical energy. At every step in the scale of being, everything that lives is capable of increasing the fraction of the energy of the universe that is utilized. The palpable result of "evolution," in whatever field it shows itself, is definitely expressed by an increase of the energy utilized. But utilized energy must not be confounded with available energy . . . .[p. 195].

One of the general facts to be taken into consideration is the bond between nomadism and plant and animal devastation.

When in the preceding chapter we examined some forms of pastoral nomadism, we were careful to say that nomadism was not merely a fact of the pastoral art. There is nomadism as soon as there is periodic devastation. Should we not then see in pastoral nomadism a nomadism connected with destructive exploitation? In this case the direct agent of destructive exploitation is not man, but the flocks and herds, sheep or goats, camels or horses, which he drives. (See chap. IV, sections 5 and 6; and Fig. 135, p. 305, and Fig. 136, p. 308.) But these are particular and, moreover, very well characterized cases of a more general phenomenon.

There is a more or less regular nomadism in fishing, hunting, "gathering" (collecting wild products), and in forest devastation.[1] There can be even a more or less regular nomadism in cultivation when this cultivation is so primitive that it falls into the category of phenomena of destructive exploitation.

To make our thought clear we shall give, in some detail, a typical example.

2. A COMPLEX TYPE OF PLANT AND ANIMAL DEVASTATION IN THE EQUATORIAL FOREST: THE FANG[2]

The Congo equatorial forest is to-day the field of migration for the Fang. Lost in the natural or artificial clearings of

[1]Even in its perfected form, the exploitation of forests can bring with it a sort of nomadism; see *La Géographie*, July 15, 1909, p. 49.

[2]The essential points in this section are from a study on the "Nomadisme des Fang," published by Father Martrou of the Congregation of Saint-Esprit, missionary to the Congo, in the *Rev. de géog. annuelle* of Professor Vélain (Delagrave, Paris), III, 1909. Louis Martrou is one of the earliest scholars of the Geographic Institute of Fribourg.

the forest, the Fang[1] move about invading the dwelling-places of other peoples who give a tacit consent. Often they perform acts of violence which make them feared by their more timid or weaker neighbors: Mpongwe, Nkomis, Galoas, Bulus, Akélés, etc. Their migrations result from a whole series of facts of exploitation of natural resources, plant and animal.

Geographical Environment

We propose to study here the Fang, not in the whole breadth of their distribution, but in the region of the Middle Ogowe. This region forms almost a circle with a radius of about 61 miles[2] (100 kilometers) with Njole as a center, and extends along the river from Samkita to Mount Otombi, from the Upper Abanga on the north to the sources of the Lébé on the south. With the exception of a few Akélé villages, at Samkita, on the Mbomi and on the Lébé, all the human establishments are of the Fang race, speaking the same language and having the same ethnic origin.

This district is representative of the different Fang habitats, for it is the point of contact of several natural regions of the equatorial forest:

a) The region of Samkita and of the Lower Abanga ends toward the north with the limit of the raffia (*Raphia vinifera*).

The Ogowe River, after crossing the last ramifications of the Crystal Mountains, broadens to a width of from 2,600 to

[1]Numerous studies on the Fang have appeared. We note in particular: Liotard, "Les Races de l'Ogooué, *Anthropologie*, VI, 1895, pp. 63 ff.; R. P. H. Trilles, "Proverbes, légendes et contes fang," *Bull. de la Soc. neuchâteloise de géographie*, XVI, 1905, pp. 49–295. (We write the plural of "Fang" without *s*, after the example of Père Trilles.) In this connection and for comparative data, see also the books by Mgr. Le Roy on *Les Pygmées* and on *La Réligion des primitifs*; that by W. Schmidt, *Die Stellung der Pygmäenvölker in der Entwicklungsgeschichte der Menschen* (Buschan's collection), as well as the first volume of Jerome Dowd's *The Negro Races, A Sociological Study*, Vol. I, *The Negritos*, New York and London, 1907, xxiii+493 pp. and one chart. Reference may again be made to a brief article (accompanied by a chart) prepared by a specialist, J. Deniker, "Distribution géographique et caractères physiques des Pygmées africains (*Négrilles*)," published in *La Géographie*, VIII, 1903, pp. 213–220.

[2]The map which we add to the text has no scientific pretensions. It is to be attributed to L. Martrou and is rather an outline, as accurate as possible, the result of sketches hastily made from a canoe or on explorations in a country covered with forests where the topography is exceedingly difficult; see Fig. 139, p. 353. The materials for this map were obtained previous to the studies which the author made at Fribourg under the direction of Paul Girardin. It was published, in 1909, by the *Rev. de géog. annuelle* and was, very obligingly, sent to us by Professor Vélain and the Delagrave house.

6,500 feet (800 to 2,000 meters). On all sides are channels, lakes, and *marigots*.[1] These flow from rivers. A thick layer of alluvium brought from the slopes of the upper river has been deposited upon the clays. It is a fertile land, well watered, where the banana prospers and the rivers and lakes are full of fish. Some rather pronounced undulations appear here and there. It is a country particularly favorable to human settlement.

b) From Nzum, going up toward Njole, the mountainous region begins — the edge of the African plateau. Its folds run perceptibly north and south, from 500 to 800 feet (150 to 250 meters) in altitude. The Ogowe crosses these folds at right angles over rapids, as at Talagonga. Here erosion is intense and the youth of the landscape is shown at every step: V-shaped valleys, very steep slopes, falls in the affluents of the Ogowe, numerous and very much intrenched small streams, pot-holes by thousands, which are seen when the water is low, and which after the rainy season have changed in form and size, hollowed indifferently in the hard or soft rock — quartz, schists, laterites, and conglomerates of every sort. There is active erosion on the steep hill sides, especially if they are deforested; the upper layers of humus are carried away and only the yellow and compact clays are left.

c) Erosion, working backward from the baselevel toward the sources, has not yet finished its work, in the mountainous region, on the affluents of the Ogowe. It has met with rock sills which offer resistance and which the rivers cross by means of falls or series of falls. Thus the Missanga, which ends at Njole, crosses one of these sills with a single leap of 130 feet (40 meters) about 30 miles (50 kilometers) from the stream into which it flows. The Abanga descends through a series of cascades of 30, 65, 100 feet in height (10, 20, 30 meters), after having received the waters of the Nkam; and the Lébé and the Mbomi also have their falls. These sills form secondary baselevels, limits to the alluviation of the upper regions, and we find there, separated from the lower districts by gorges, in the midst of a hilly or mountainous

[1]Name given in Senegal to lakeside affluents; means also low regions where rain water collects.

country, regions of alluviums of a particular type, small geographical worlds comparable to the high valleys of the Alps.

d) At some miles from the island of Alembé and from the

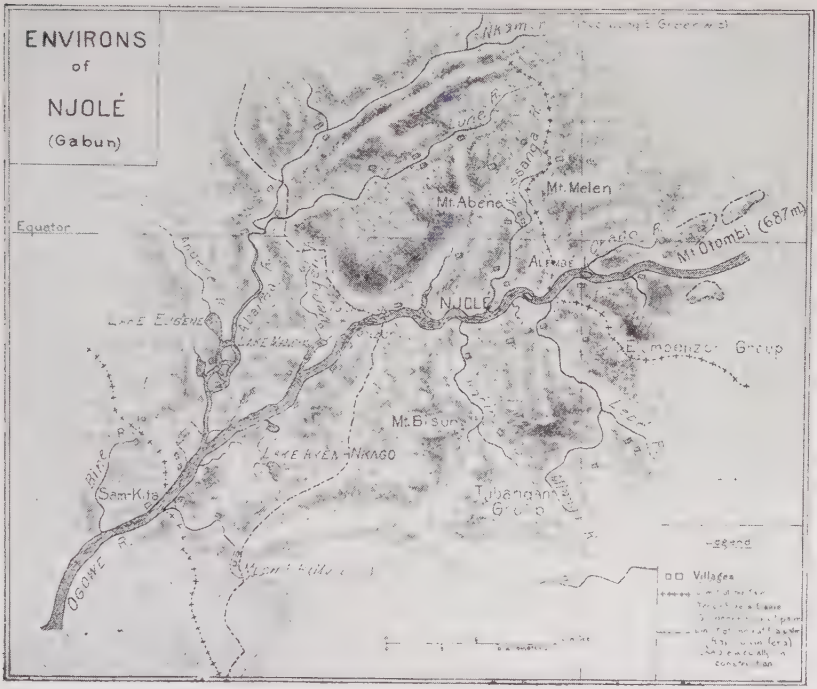

FIG. 139. OUTLINE MAP FOR THE STUDY OF THE NOMADISM OF THE FANG; NJOLE REGION

(After the engraving in the Revue de géographie annuelle, Vol. III, 1909)

mouth of the Okano begins what is improperly called the region of the plains. The forest, which up to that point covers the whole country, narrows to a line along the river or to patches determined by a little humus or vegetable mold. The rest is covered by siliceous grasses; some few stunted trees remind one of the vegetation of the Sahara. The impermeable soil is covered with ferruginous and quartzose pebbles and boulders.

From the plateau above which rises Mount Otombi, 2,250 feet (687 meters), a superb view of this region is obtained, half forest, half savanna; the slopes are gentler than below and the

hills are rounded. One can trace the watercourses or the strips of vegetal soil by the line of the forest. This immense horizon is a restful sight for the prisoner in the equatorial forest who ordinarily has no horizon other than the opposite bank of the river upon the shore of which he has built his house.

Climate

It is easy to form an idea of the climate of this equatorial country when we know that Njole is at 0° 8′ S. latitude (longitude 8° 37′ east of Paris or 10° 57′ 9″ east of Greenwich).

The first rainy season, which the Fang calls *surœ*, begins usually in the early part of October. The rains, which are at first moderate, become very abundant in November, and are accompanied by wind storms coming generally from the northeast. Sometimes the precipitation in a single day is very great. Thus on November 22, 1906, between six o'clock in the evening and nine o'clock the next morning, there was a rainfall of 7 inches (180 millimeters); at midnight the rain gauge —capacity 4.7 inches (120 millimeters)—w s overflowing.

After this violent rain important landslides were found everywhere upon the banks of the Ogowe. The gullying had brought down trees, walls of rock, and great quantities of earth torn from the sides of the hills. The important landslides of April, 1904, traces of which can still be seen at Nzum, Talagonga, and Njole, must be attributed to a similar rain. The Ogowe and its affluents, which are registers of precipitation and indicators of climate, rise rapidly. From the 15th of September to the 20th of November there is a difference of 21.3 feet (6.5 meters) in the level of the water at Njole. Toward the 20th of November comes the great flood, the *clay flood*, as the Fang call it (*ndœus bikonœ*). The Ogowe rolls along, its yellowish, foamy waters carrying trunks of trees and débris of every sort.

With December the rains gradually diminish, without, however, altogether ceasing, and the temperature rises. In February and March we find maximum temperatures of 30° C. (86° F.) in the shade. This is the *esep* of the natives, the short dry season of the Europeans. The waters of the river fall and the sand banks appear. This is the flowering period, and

especially the period of the maturing of the fruits; under the warm sun after the rains plant life becomes exuberant.

Toward the 15th of March the rains again become heavy and continue into April and May. This season has the same character as the rainy season of October-November; toward the 25th of May the swelling of the Ogowe reaches almost the same level as in late November. But a phenomenon peculiar to this period appears — the tornado, which twists and even overturns trees and damages dwellings.

Then comes the dry season, *oyun* (from June to the 20th of September); by July the rain has ceased entirely and the temperature falls. In July and August we notice minimum temperatures of 18°–17° C. (64°–63° F.) at Njole. There is much cloudiness, and the sky is gray, with only a few hours of sunlight from eleven until one o'clock. Vegetation is less intense; there is a partial arresting of vegetative activity and certain trees lose their leaves. The water falls rapidly in the river and the sand banks obstruct the river beds. Toward the end of August and in September the little steamers which draw more than 3 feet (1 meter) cannot find a channel to go up to Njole.

This is the favorite season of both the natives and the Europeans. One may sleep in the open air, on the sand banks, or in the open forest. The roads are dry, and fishing is good in the marshes, the lakes, and the rivers.

TABLE OF PRECIPITATION OBSERVED AT NJOLE
LONG. E. OF GREENWICH 10° 57′, LAT. S. 0° 8′
(In inches)

	1903	1904	1905	1906
January	.....	7.09	2.92	1.3
February	.....	3.51	4.15	5.8
March	2.9	6.89	4.1	...
April	10.22	15.95	5.52	...
May	16.9	8.35	4.74	...
June	0.17	2.9	0.27	...
July	0.16	0.06	0.09	...
August	1.1	0.24	0.14	...
September	6.4	4.6	3.54	...
October	14.0	8.35	5.92	...
November	9.3	8.43	11.04	...
December	4.1	4.05	5.76	...
Totals	.....	70.42	48.19	...

The Main Establishments of the Fang: the Village

The Fang village is always built near a stream of water. Wells, cisterns, and aqueducts are unknown. In this equatorial climate where precipitation is abundant, rivers are not lacking. It is therefore easy for the Fang to locate themselves near water. They usually establish themselves on the bank of a brook, river, or lake, but they choose a place where the banks are high enough so that there is no risk of their being reached by high water.

The village is composed of a street bordered by two parallel lines of rectangular huts all joined together. The two ends of the interior court are closed by two *abeñæ*, or guardhouses, solidly built of round pieces of *asæis* (*Musango*), a soft wood through which the native bullets do not easily pass. In case of war with the neighboring villages there are always some guns night and day in the *abeñæ*. The narrow door and loopholes give a view over the road and the river.

The *abeñæ* serves as a meeting place for the men and a reception room for strangers. Here also the men eat in common. If the village is important, there are two, three, or four other guardhouses within the court in addition to the two *abeñæs* at the ends. This common hall, built by a group of men, is under the care of an old man who sweeps it, keeps up the fire, and governs morally his modest but noisy areopagus.

The double row of houses, bordered by a narrow gallery, consists of separate huts for the men and the women. They are built of wood and bark, without stone, cement, or clay; stakes stuck in the ground support a light framework sometimes of raffia, sometimes of *elæis*, sometimes of amomum stalks, which are covered, according to the region, with tiles of raffia leaves or other leaves sewn together. The walls are made of tree bark, beaten and dressed, arranged in strips and fastened to the posts by vines. These huts are very light, require little work, and show by the materials used the plant geography of the region. Thus, for example, in the region from Samkita to Nzum and higher up the river from the Lébé to the island of Alembé, regions where the *Raphia vinifera* abounds, the hut is almost everywhere built of the wood and covered with the leaves of the raffia; while from Nzum to

Njole, where only the oil palm is found, the building is much more difficult. This is one of the reasons why this latter region is less populated and would perhaps even be totally deserted if the commercial center of Njole, the terminus for navigation with small steamers, had not drawn numerous villages into this district (Fig. 139).

Behind the huts extends the banana grove. Here each woman has a few feet of banana trees, pimentos, sweet potatoes, etc. When an unexpected guest arrives, or when the weather is too bad to go to the distant plantations, she uses the fruits from the banana grove. Women's yard, and a burying ground, the banana grove plays also the part of those little gardens which are seen in certain regions in France in front of country houses, in which are planted such things as lettuce, parsley, and onions to avoid the necessity of going several times a day to the vegetable garden, which is in some cases far away. This is, however, only a small cultivated patch, a "reserve" of secondary importance.

How then do the Fang live? They live by the devastation of the forest — gathering and cultivation — and by fishing and hunting.

Gathering, Exploitation of the Forest, and Cultivation

Almost all the fruits of the forest ripen in the sunny days of the *esep*. A certain number of these fruits are edible and are used by the natives. The Fang know these trees and pluck their fruits at the proper time.

Sometimes the labor of fruit gathering makes a temporary camp necessary. Four or five trees called *ascia* (terebinths) are felled, the fruit of which, when cooked in water, is held in high esteem by the natives and even by Europeans. The children gather fruit and, after boiling it in a kettle, eat their fill of it, repeating this program several times a day. The women fill their baskets with the fruit to carry to the village, or even, after cooking the *ascia* and removing the kernel, make packages of the pulp, properly salted and spiced and sewn up in leaves, which will keep for from ten to fifteen days.

It is especially for gathering the *ndoi* (*Irvingia Gabonensis, Oba Gabonensis*) that the Fang go into the forest regions

where this tree abounds. In the regions of Samkita and of the Lower Abanga an entire month is given up to it. A camp is built in the best place and the man goes there with his women at the moment when the mellow fruit is falling to the ground. They clear away the space beneath the *andor* and every morning the women visit all the trees and take up the fruit, which they place in a pile. When the pulp loosens of itself, they wash the kernels, split them, and fill their baskets with almonds. When all the fruit has fallen or all the baskets are full, the campers go back to the village to make the precious oil cake. It is the women who do this work; the men only build the temporary camp and protect and govern this short-lived colony, which is far from the village.

European commerce, which has come into the Congo to exploit the rich natural products of the equatorial forest, both flora and fauna, has had its influence upon the work of the natives. Except under the stimulus of European influence, the ebony, mahogany, rosewood, copal gum, and rubber are not used. The few objects made of ivory—trumpets, pipes, and spoons—give only a slight value to the tusks of elephants. But as soon as the white people buy these products in exchange for highly prized objects, a new branch of native activity is formed to find and exploit these natural riches.

In the territory which we are discussing, the *Apocynaceæ* (vines) and the *Fici*, from which the Fang get rubber, are relatively rare. This is doubtless the result of the prolonged and pronounced exploitation of these regions, a condition which has long been known. It will not astonish us when we learn that the Fang cut the vine close to the ground instead of bleeding it, and, on the other hand, that the vine multiplies by means of the seed of its fruit.

The Fang, especially in the last few years, have sold much ebony to the trading-posts of the Lower Ogowe. They first cut the trees on the shores of the river and of the navigable streams and channels. But at the present time the ebony is far away; men must go a long distance to cut it and must carry it upon their backs along difficult paths. When work is not pressing in the village and when some European merchandise is desired, it is decided to go camping in the forest, 6 or 7

miles (10 or 12 kilometers) away, perhaps, and go "ebonying." A few men with their women establish themselves in a corner of the forest which is rich in ebony trees. For some days the men cut the trunks of these trees, split them in logs of from 65 to 130 pounds (30 to 60 kg.), and remove the hard outer layer. Finally, when the stock is considered sufficient, the women form a caravan to carry the pieces of ebony to the village or to the navigable canal. They make as many trips as the number of logs requires.

The Fang are not content with these direct depredations in the forest. They cultivate, but their cultivation presupposes and causes renewed devastation. When the *aboiæ nzoi*, a tall tree with twisted branches, has no more leaves, and when the fruit of the *surœ* has fallen, it is time to begin the work of the gardens.

We have said, in studying the climate, that the maximum intensity of plant life coincided with the short dry season (the month of March). The Fang know this and set out at the end of January. They go into the forest and find a favorable place, settle in common the respective limits of each plantation, and the work of cutting the thick-growing underbrush begins. This work is done by men and women armed with the *machete*, a tool imported from Europe which the Fang have adopted in place of the *fa*, a two-edged cutlass which they formerly made themselves.

The underbrush once cleared away, the men cut down the big trees (*ba baibiti*), leaving here and there only some few giants too strong for their attacks, or some few trees with edible fruits. All the others are pitilessly cut down, never close to the ground, but 6 to 15 feet (2 to 4 meters) above it. The Fang fasten themselves to the trunk in a sort of sling and thus fell the trees they have selected.

This work is long and laborious. In the beginning of March, after the long, sunny days of February, the stalks of the bushes, the reeds, the branches of the trees are chopped up in pieces and burned, and soon, in place of the great forest, there remain only the big trunks lying on the ground. In this ground, covered with ashes and humus, the women place banana plants, stalks of manioc, and seeds of gourds. It is near the end of

March and the precipitation becomes abundant; hence banana trees, manioc, fruits, and vegetables ripen rapidly. For his cultivation the Fang is then dependent upon water; he waits for the rain and regulates his work accordingly. Woe to him if his calendar or his activity fails him; that will mean a partial scarcity of provisions. If the rain delays more than usual, or is less abundant, the plants will suffer and will yield but small crops. The banana tree in particular is rather delicate; a prolonged dry season after a short season of rain sterilizes it and prevents it from producing its natural yield. On the other hand, if the precipitation of the *surœ* surprises the Fang before he has burned the trees he has felled, his incompletely burned plantation, entangled with branches and stalks and not having the ashes to fertilize it, is rendered useless for that year.

There is no general famine among the Fang as in India and in the monsoon countries. This is due to the fact that the native plants, manioc and yams, are rather hardy. The same banana trees bear at all seasons, though their yield is greatly diminished during the dry season. There is no harvest and therefore there are no barns. The garden lasts for two years and the people go to it for their provisions according to their need until it is exhausted. At that time the new garden should be bearing. There will therefore be a scarcity of provisions if the garden is exhausted before the new one begins to produce, or if the provisions are not abundant enough for the family. No one dies of hunger, however.

Whenever the gardens that are to be started are at a long distance from the main village, an hour's walk or more, a *mfini* or plantation village is built. It may be said that this is usually the case for groups whose main village remains for some years in the same place or whose near-by lands are not favorable for food plants. It is then necessary to seek favorable land in the virgin forest far away, for the Fang know absolutely nothing of intensive cultivation. With their primitive agriculture they need immense stretches to support the smallest group of human beings. Every year, then, new sections of virgin forest fall under their destructive axes.

Fortunately after twenty years the forest reasserts its right and we see no longer any trace of man's work.

The *mfini* of the plantations is identical with the village, built on the same plan, though not so well; the street is not so wide, the huts are less substantial and without gallery. This is the temporary center of life during the work in the gardens. Outside of the period of agricultural work there are always some few persons who keep watch over the gardens lest marauders should pillage them or wart hogs or elephants ravage them.

Sometimes though, when the chief village is threatened, it is abandoned and the *mfini* becomes the real social center. This often happens on the Ogowe at the time of the collection of the taxes. If the village is important (with four or five guard-houses), it has several *mfini;* each village has its own in the midst of its plantations.

The inhabitants of the villages of the savannas have no *mfini;* they make their gardens in the surrounding forest. When this is exhausted they move farther on. In the same way the villages situated far from navigable waters make their plantations within the radius of an hour's travel, and when this circle of forest is exhausted they begin once more their migrations. When the work at the plantations is ended the men and women go back to the village where they had left those who were too old or too young to work. Even during the working period they had gone back to the village individually or in groups for a *palaver*—a mourning, a dance, or merely for a walk.

We find the workers in the fields at the *mfini* at other times of the year. In June the weeds which have grown with the rains threaten to stifle the young plants; the women weed them out and cut them with the *machete*, or long knife. In the midst of the dry season, in August, in order to be ready for the first October rains, new clearings are made, but smaller than the others, for the sowing of maize, groundnuts, cucumbers, tomatoes, pimentos, etc.; all these vegetables will ripen in the warm and sunny days of the *esep*. But everywhere and always devastation is the prelude and fire the necessary condition of cultivation.

Fishing and Hunting

Toward the 15th of August the waters have gone down considerably. The Fang, especially in the region of lakes and ponds, have long been awaiting the happy event and watching with an attentive eye the falling of the waters. At last a certain tree trunk or a stone in their wharf which serves as a mark appears above the water and they can go fishing.

The Fang then build a camp on the shore of the lake, *marigot*, or river where they intend to fish. Very few people remain in the village. All, big and little, wish to have their fill of fish, and they can all aid in the work of fishing.

The *palavers* cease; there is a tacit truce caused by a common need. They must profit by the dry season, especially the last six weeks. The cast-net brought in from Europe, nets of pineapple fiber, dams, draining of pools, poisoning by herbs — every means is put into practice to catch the fish. During the first days an enormous quantity is eaten; then the work of smoking and preserving the fish is begun.

The camp is very large, the site well cleared, the roofs high, the drying-house made of sticks of raffia well built. There are sometimes several parallel streets. Even the dogs and the chickens are brought here from the village. At nightfall the camp grows animated. Their hunger satisfied, the Fang, gay and numerous, chat and sing under the vault of great trees and tell the old stories of their folklore.[1]

On a certain shallow well-stocked fishing lake of the Lower Abanga, Lake Eugene, Louis Martrou saw in 1902 a dozen camps of this sort, and yet the lake has hardly more than a square mile (5 square kilometers) of surface.

The inhabitants of the mountainous region and of the savannas are less favored. Fish are not abundant because the cold, deep waters are too swift and flow over rocky bottoms. And yet the people try to procure a few fish. They dam the smaller brooks and drain the pools of the branches of the river. They always go camping four or five days on the bank of some stream and come back with a few small fish, shrimps, crabs, and catfish; at any rate they have eaten fish.

[1]See the interesting studies by R. P. Trilles, "Proverbes, légendes et contes fang," *Bull. de la Soc. neuchâteloise de géographie*, XVI, 1905, pp. 49–295.

With the plant food (manioc, bananas, yams) the products of their fishing form the basis of the food of the Fang. The barnyard of a Fang village does not amount to much: some thin chickens, a few Barbary ducks, a few sheep and kids—a dozen per village—are the entire "stock." And the kids and sheep are "reserved" for the payment of a pressing debt, the conclusion of a marriage, or for the fetish to be asked from the medicine man in case of a serious illness.

It is easily understood, then, that the Fang, after having fished the waters, hunts the forest for a very necessary addition to his plant food. He goes hunting with his gun and his dog, calling the game by imitating its cry. He is lucky if he brings back a monkey or a porcupine. He skins the animal, keeps a large share, and the remainder goes to his table companions in the guardhouse.

But game has its habitat far from groups of human beings. It is most frequently found in certain solitary districts of the forest near streams or near trees upon which it may depend for fruit. The Fang know this and at certain favorable seasons they move to these places to hunt. Once more they build a camp, but more simple than the one before mentioned. Posts stuck in the ground, a framework supporting a roof of tree leaves, a drying-house, a hearth, and a bed—such is the hunting camp. A dozen men and two or three women go thither. The women do the cooking, go after wood, and smoke the pieces of meat in the drying-house. The men hunt all day. At other times they shut off a corner of the forest with a palisade, digging deep ditches at intervals, which they carefully cover with leaves and twigs, and at each of these places leaving an opening in the palisade. The animal, wart hog, antelope, etc., seeking a place to pass through, falls into the ditch and is found the next day. It is at the time of the great floods that this arrangement of fences and ditches, which has had to be made some time in advance, is fruitful. Peninsulas and isthmuses are formed where much game takes refuge or passes, and then good catches are often made.[1]

[1]While hunting, digging ditches, or making traps to catch game, the Fang must be continent. This, he says, makes him more agile in pursuit of the animal and more successful in his hunting. If he violates this prohibition, the game is sure to escape and make sport of the lazy hunter. Thus there are few women in the hunting camp.

After ten days, two weeks, or three weeks at the most, this hunting season comes to an end and the Fang go back to the village with the dried meat, which for some time will give variety to the food supply of the lucky hunters. It is impossible for them to remain very long in the forest, since the provisions they have brought with them are quickly used up and it is then necessary to go to the plantations or the village for a fresh supply.

The Great Migrations Resulting from These Forms of Destructive Exploitation

All this moving about and these more or less prolonged stops, either at the ephemeral camps of the forest to gather its fruits and products or to hunt, or at the more stable fishing and garden camps, do not prevent the Fang from going back to their village. They go back with pleasure; here is their hut, their home, the burial place of their recent dead.

To see one of these animated villages where the inhabitants seem happy in their careless life, one might think that it was going to remain there forever, that it was going to become attached to its environment, to the plot of ground which it covers. Not so — it is there but for a time; it is but a stopping-place, a halt in the migrations of the Fang.

After four or five years the village needs repairs; there are holes in the roofs, the bark is damaged, and the courtyard full of gullies. If the inhabitants decide to remain in the place, they rebuild the village, moving it twenty, thirty, or a hundred yards farther on to avoid some inconvenience they have noticed, such as too steep a slope in the yard, too great a distance from the river, or a bad exposure with no shelter from tornadoes. The restored village keeps the same name.

But some day, at a turn in the river, on the shore of a stream where hitherto was only the forest, we see a new clearing, a few wretched provisional huts (*bikukula*), with a few men as an advance guard. To this point a village is to be moved. As the old village falls in ruin, the number of provisional huts in the new one increases. Finally, one day, the whole tribe proceeds to the new establishment, carrying the children, the boxes full of old clothes, the kettles, the kitchen utensils, and

the fetishes. The distance is sometimes 15 or 18 miles (25 or 30 kilometers) in a straight line, and it takes several days for this nomadic horde, encumbered with baggage and children, to reach its new home. They travel by day and sleep at night in the forest, and at last reach their destination.

The first months in the new village are hard, for there is a lack of provisions, although they have brought some with them. Those who went on ahead have made a few gardens, but these have not begun to yield. Hence they are forced to borrow or buy provisions from the neighboring villages, though this is not enough completely to satisfy them. They therefore immediately set about the agricultural work, although it will be some time before they will eat the first vegetables from the new plantation and think of building the true village, leveling the courtyard, and constructing the *abeñæ*. In the beginning they still have "a gnawing in their stomachs" and they do not build. And then, too, they are still very unstable, like a bird on a branch. Any one of a number of events or difficulties, the hostility of neighboring villages, unexpected deaths, may lead the tribe to return perhaps to its former village, or it may go farther in search of a safer and more favorable spot.

But usually the Fang remain in this new country, which they quickly learn to know and to exploit, beginning here again their organic nomadism. And during this time their *élic* (former village) becomes covered with tall grass and weeds. Soon the equatorial forest which surrounds it closes the wound which human toil had made in its closely tangled mass, and of this place, so alive a few years before, there remain but a memory and a name. The tribe adds it to the already long list of its many stops in the savannas and forests of Africa.

The length of these stops varies. Economic and social reasons may fix a village for some years, stop it for a longer time than usual on its nomadic course. The village of Ayais (family Esaisfan) of the Middle Missanga has been for fifteen years at least in the same district on the shore of the Metomœ. It is true that this is one of those superior oases of which we have spoken.

Andor, on the Ogowe, at the outlet of Lake Mangeis, is an

old village, several times rebuilt. The children who were born there at the time of its origin are now young persons of twenty years of age and more.

But these are exceptions; the average duration of a village is five or six years. An old man of Njole, in telling the history of his tribe, located his native village on the Lom, a small tributary of the Upper Uindo. And since that time his family had moved its village thirteen times. This old man was between sixty-five and seventy years of age.

Is this rapid movement of the Fang tribes, these periodic migrations, to be explained by reasons found in the geographical environment alone? Not entirely. A village may change its place as a result of a war with other villages. The hostility of a powerful tribe, the collection of the tax, the death of an important man, some superstitious reason such as the cry of an owl in the neighborhood, may cause the family to move toward another region, and in this case the change is due to human will or human caprice. It is none the less true that the more fundamental and general causes of the migration are geographical and result from destructive exploitation.

As we have said, it takes a considerable extent of ground to support a Fang village. As their method of cultivation is primitive, without fertilizers or tillage, the garden is abandoned after the second or third crop. Every year hundreds of acres of forest fall under the axe of the Fang. The plantations are soon too far away from the village, and the village moves on to find the great forest.

Sometimes a village leaves a region because its plantations of banana trees and manioc are ravaged by animals, especially wart hogs or elephants. In the region between Lake Ayen-Nkago and the Mbomi a troop of about thirty elephants had established itself. The natives hunted them, but only one or two were killed. The villagers were obliged to remain in their *mfini* during the season of cultivation, to build fires on the edges of their gardens, and to keep watch, beating the tom-tom to keep away the marauding beasts. If they relaxed their vigilance, an entire plantation might be devastated in one night, and that would mean want for a long time to come. Several villages, therefore, migrated, in spite of their desire to

remain in this region which was both fertile and full of game. The elephants drove them away.[1]

Finally, what shall we think of the proverbial paradox about the eagerness of the Fang for our European merchandise: "Take away all the trading-posts of the Gabun and of the Ogowe and leave only those of the Senegal and in twenty years the Fang will be at Dakar and at Saint Louis?" It is true that villages are built around a European trading-post. Many families of the interior leave their old village to come toward the "new Eldorado." But disillusionment soon comes. Before long they learn that the white man gives his powder, trading guns, fabric, and hardware only in exchange for products. In order to obtain these products soon they must resort to tilling the soil, and thus they again take up their old life. Some day, whether or not they wish to do so, they again become nomads.

Through the immense forest there are, as it were, veritable "lines of nomadism," human *thalwegs* which spread out fan-shaped, like the branches of a delta, from the sources of migration.

By taking the present position of a village on the Ogowe or in the region along the coast of the Atlantic and by marking the former sites of this village in the equatorial forest on the banks of rivers and small streams, we obtain a line with a constant direction. The point of departure which the contemporary natives give for their permanent nomadism is the region comprised between the sources of the Ntem and the sources of the Uindo. The memory of the old men gives no clear and precise information beyond this district, where from sixty to eighty years ago were the present villages of Njole and of Samkita.

Sometimes in this constant line of nomadism there are sudden turns or crooks. Some commercial center has attracted the family clan; then, the attraction ceasing, they have continued their migration, coming back to the line running west or southwest.

These "lines of nomadism" make disastrous trails in the

[1]Have those who condemn the killing of the elephant as useless and harmful considered this economic side of the question? It is impossible for native villages to exist when there are any elephants within a radius of from ten to twenty miles.

equatorial forest, for it is evident that the passage of the nomadic Fang in close ranks diminishes its natural richness. These forests successively felled for primitive cultivation and replaced by the bushy vegetation of thickets; the zone of the banana constantly narrowing, and the lands which produce it becoming more and more rare; the rubber vines cut and lopped off; fruit trees felled to facilitate the gathering of the fruit — such are the geographical consequences of this complex and varied nomadism.

Moreover, the Fang, since they have no thought of remaining permanently, do not plant fruit trees even where they would succeed very well, for at the time when these trees would be in full bearing the planters would be far away and neither they nor their children would profit from their work.

One may imagine that all this life resulting from human toil shapes the history of the Fang people. One may also easily see that such phenomena are not without their effect upon social relations.

Let us leave this typical group of primitive peoples (*Naturvölker*), living in truth from *Raubwirtschaft*, to observe among the most advanced groups of civilized peoples (*Kulturvölker*) the effects of another form of destructive exploitation.

3. THE EXTRACTIVE INDUSTRIES FROM THE GEOGRAPHIC POINT OF VIEW

Mineral devastation does not cause a nomadism as visible or as immediate as that before mentioned, but in its rudimentary form, which might be called plundering, it causes changes of place at the will of circumstances which make it resemble a hunt. The first gold rush to California or to Alaska formed a sort of migration.

A manufactory associated with an extractive industry may also be subject to movement. Glass-making in the United States at first depended upon the devastation of the woods, then upon the devastation of coal (Pittsburgh), finally upon natural gas, the "springs" of which are always short-lived. Thus the glass factories are moving from place to place over the United States almost like a flock of sheep, but a flock which never comes back to the same place. This "nomadism"

of the American glass industry (or that of the exploitation of placer gold) is not a true nomadism, for it implies no return, no periodic movement. The necessity for migration is inherent in every mode of activity that is either closely or distantly bound to a definite form of extractive industry.

However, the essential characteristic of mineral exploitation is to fix the work of man, for the moment at least, at a precise point on the earth. Thence comes the exceptional geographic value of all forms of mineral exploitation.

A study of the exploitation of quarries and of mines may be made in the form of a special local study.[1] A similar study might be made of the sulphur mines of Sicily, the copper mines of Rio Tinto, of the tin of the Malay Peninsula.

The study of the general distribution of a mineral must never be neglected, nor, if possible, an examination of the general geological causes of this distribution (see Fig. 143). Moreover, the geographer must investigate the geographical facts of surface and depth—what we might call exterior and interior landscapes. At those points where man undertakes the exploitation of a product furnished by the earth, he establishes himself in a fashion which modifies the natural topography. In centers of petroleum exploitation, such as Bibi-Eibat and Balakhany, near Baku (Russia), man's work appears in characteristic forms: the forest of pyramidal oil-well towers or the great petroleum reservoirs (Figs. 141-143).

It is important to emphasize finally, from the economic point of view, the "speed" of certain of these phenomena. Petroleum has been exploited at Baku only since 1865 and in Pennsylvania only since 1859. The production of petroleum in Texas went from $772,000 in 1901 to $2,895,000 in 1902.[2]

The facts of mineral exploitation may and must be examined

[1] G. D. Hubbard, *Gold and Silver Mining as a Geographic Factor in the Development of the United States*, Cornell University thesis, 1905, 102 pp.; seven published papers bound together as one, Oberlin, 1912; of these, see especially: "The Precious Metals as a Geographic Factor in the Settlement and Development of Towns in the United States," *Scottish Geog. Mag.*, XXVI, 1910, pp. 449–466; "The Influence of the Precious Metals on American Exploration, Discovery, Conquest, and Possession," *Bull. Amer. Geog. Soc.*, Vol. XLII, 1911, pp. 594–602.

[2] See L. C. Tassart, *Exploitation du pétrole, Historique, Extraction, Procédés de sondage, Géographie et géologie, Recherche des gîtes, Exploitation des gisements, Chimie, Théorie de la formation du pétrole*, Dunod and Pinat, Paris, 1908; see also the excellent review of the geographic substance of this volume given by M. Zimmermann: "Les Gisements et la production actuelle du pétrole," *Ann. de géog.*, XIX, 1910, pp. 359–366.

under different aspects. They have been examined especially from the point of view of the engineer, the chemist, the geologist, the economist, and the statistician, but they have

U. S. G. S.

FIG. 140. DISCHARGING OIL INTO RESERVOIR. SCENE IN THE MCKITTRICK OIL FIELD, CALIFORNIA

received less attention from the geographic point of view. Now we must indicate clearly from what angle geography, and especially human geography, must look at these facts.

These facts proceed from certain needs or appetites of man;[1] they rest upon discoveries and technical establishments, and they lead finally to forms of population which cannot be otherwise explained.

[1]It is evident that certain mineral products (salt, iron, etc.) have played and continue to play a very important part whether in the life of primitive people or in the historic vicissitudes of civilized nations. We ought especially to mention, as far as minerals are concerned, in connection with human geography, Part III (which, to our mind, is the best) of J. G. Kohl's book, *Die natürlichen Lockmittel des Völker-Verkehrs: Bemerkungen über die wichtigsten rohen Naturprodukte, welche die Ausbreitung des Menschengeschlechts über den Erdboden gefördert, zu Länder-Entdeckung, Ansiedlung, Colonien-Stiftung und Städte-Bau Veranlassung gegeben und in der Geschichte der Geographie eine hervorragende Rolle gespielt haben*, Ed. Müller, Bremen, 1878. We note also the volume by Richard Andree, *Die Metalle bei den Naturvölkern mit Berücksichtigung prähistorischer Verhältnisse*, Leipzig, 1884. Let us say at least in a word that many of the prehistoric or primitive civilizations have been distinguished from one another and it has been possible to differentiate them precisely, by means of the minerals that they have known how to treat, and by the metals which they have been able to utilize or to amalgamate; among a great many examples, see Dr. L. Laloy, "Ethnographie du haut plateau argentin," *La Géographie*, March 15, 1910, p. 175, dealing with the researches and discoveries of Eric Boman.

C. W. Hayes, U. S. G. S.

FIG. 141. GUSHING WELL AT BEAUMONT, TEXAS, JANUARY, 1902

R. Arnold, U. S. G. S.

FIG. 142. INTERIOR OF CATCH METAL RESERVOIR WITH A DEPOSIT OF THE SAND WHICH FLOWS WITH THE OIL. MARICOPA WELL, SUNSET DISTRICT, KERN CO., CALIFORNIA, OCT., 1908

Oil districts are characterized by "forests" of quadrangular pyramids of wood, which provide the scaffolding necessary for the boring machines.

In chap. III we considered the cities of the world situated at a very high altitude. How are such important groups so far above the level of the sea to be explained? How have

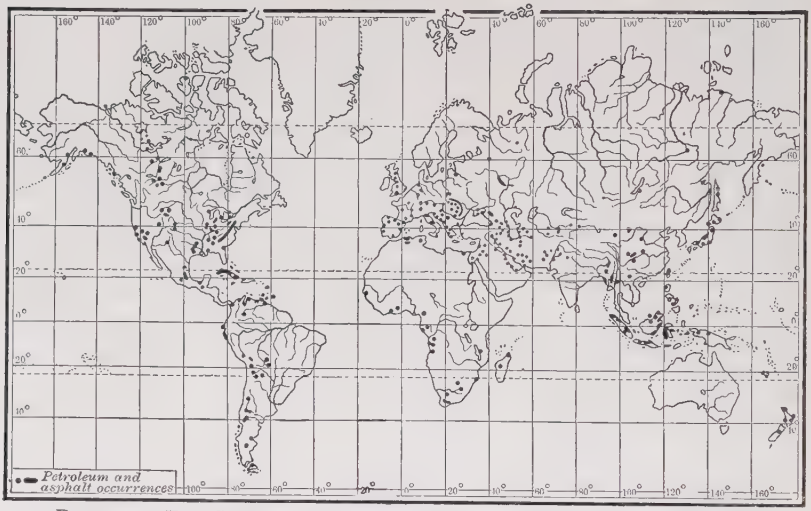

FIG. 143. THE GEOGRAPHIC DISTRIBUTION OF PETROLEUM AND ASPHALT, AFTER HOFER

This map is taken from the one published in the new review of general geology edited by G. Steinmann, W. Salomon, and O. Wilckens with the title "Geologische Rundschau."

such desolate regions, where vegetation dies, where even the fauna has difficulty in living, been able to attract such large populations? Let us go back a few centuries and ask history, or rather let us go down into the still open holes and we shall find the answer there; it is the gold, silver, or copper mines which explain facts of population apparently so abnormal.

Says Reclus: "Had it not been for a powerful attraction, Cerro de Pasco would have remained what it was in 1630, a solitude traversed infrequently by shepherds. But at that time a shepherd Quichua discovered one morning ingots of silver in his fireplace. Suddenly the crowd appeared; the city was founded as if by enchantment, and since that time its population, largely floating, increases or diminishes according to the yield of the mines or the fluctuations of the market."[1]

[1] E. Reclus, *Géographie universelle*, Vol. XVIII, *L'Amérique du Sud*, p. 590, quoting Lewis Herndon, *Exploration of the Valley of the Amazon*.

To-day more than two thousand veins cross each other below the city, but hundreds of excavations are buried under landslips or invaded by water.

Oruro, in Bolivia, owed the 70,000 inhabitants it once contained to its silver mines. These have given place to-day to tin mines. It was also the silver mines that made the fortune of Potosí, the city founded in 1545 at the foot of the Cerro de Potosí, a mountain said to be a cone of silver. Honeycombed by more than 5,000 galleries, the Cerro de Potosí forms an immense labyrinth; but here, as in the Cerro de Pasco, the increasing depth at which the galleries must be cut and the invasion of water make the exploitation difficult. However, the city still furnishes considerable quantities of silver.[1]

As to the high plateau of Mexico, it is particularly indebted to the extractive industries: it owes its past fortune to them, and to them it will owe its fortune in the future. "The silver produced in this country exceeds a third of the world production; it has been estimated to be more than 100,000 tons from 1521 to 1905, worth about 4 billion dollars (21 to 22 billion francs), for up to 1550 silver was worth more than $60 (300 francs) per kg., and up to 1875 more than $40 (200 francs)." "It is estimated that in Mexico there are more than 1,902 mining districts, of which 553 contain silver."

We know that a large part of the wealth of these mines went to the Spanish governors and another part to the churches. The cathedral of Zacatecas is a noteworthy example. Enormous sums have been expended in the building of such an imposing monument at this altitude in a rocky country which produces almost nothing.

But all wealth, however great it be, is finally exhausted, and Zacatecas, which has gradually passed from 80,000 to 30,000 inhabitants, is an illustration of what will happen to many mining cities which are to-day flourishing but are situated in countries unproductive from an agricultural point of view. Copper has indeed been found some distance away, but the work of exploration is not yet finished. One cannot escape a feeling of melancholy as one sees but a few steps from this superb cathedral and from a luxurious theater, the remains of the old cloister transformed into stables, while all about are almost uninhabited streets.

In the state of Michoacan, adjoining that of Mexico, there is a mining district which is a field of still greater activity than that

[1]According to approximate evaluations, it has supplied since the beginning of the exploitation, $1,500,000,000 (8,000,000,000 francs).

of Guanajuato. This district has recently become celebrated throughout the entire world on account of the group of mines of El Oro, comprising the Esperanza, the Mexico, and the Dos Estrellas. . . . . These new mines, now at the height of their productiveness, contain more gold than silver. Esperanza, El Oro, and Dos Estrellas have all passed four millions in dividends although they have been worked only from ten to twenty years. . . . .

The region of Guanajuato, although agriculturally more productive than that of Zacatecas, could not without the mines maintain a large city. There at the present time remain only low-grade ores, the waste heaps from former operations that are still worth handling, and finally the untouched ores below a depth of from 500 to 600 yards. The latter ores are still rich but complex and therefore much more difficult to treat than the surface ores. The problem, then, was to find a process both economical and powerful, and the cyanide process used for gold ores was tried. This process has already reached a perfection sufficient to allow the extraction of from 80 to 90 per cent of the total percentage instead of 75 per cent, at the most, which was obtained by the amalgamation of gold and silver in the *patio*.

Guanajuato is situated at an altitude of 6,539 feet (1,993 meters) and Zacatecas at 8,005 feet (2,440 meters).

Thus from the earliest times the precious metals, gold and even silver,[1] have exercised such a powerful attraction on men that they have drawn them up and kept them up on even these high plateaus where it is difficult to find the ordinary means of subsistence, and where the air is so rarefied above

[1]Let it suffice to mention the founding of Dawson City, in Alaska, where the mean annual temperature is −7° C. and where a three-month night reigns; there, in another region and under other conditions, is an example of settlement that might be called abnormal. We note again, in the sierra of Chorolque, a mine being worked at an altitude of 17,500.5 feet (5,308 m.), that is, at three-tenths of a mile (a half kilometer) higher than Mount Blanc. On the subject of gold, see the book by Hauser, the studies by De Launay, and also the book by Auzias-Turenne. In "L'Avenir géologique de l'or et de l'argent" (*Rev. gén. des sciences*, VI, 1895, pp. 362–373), L. de Launay shows why there must remain many fewer deposits of gold, the exploitation of which is practicable, than of silver, first, for a reason quite psychological—the exploitation of gold attracts more capital, more energy, and is always ahead of the exploitation of silver; in the second place, if we must admit that at the time of the cooling of the earth the heaviest materials were condensed nearest its center, then we must recognize that metals are not found at the surface, that is, within the reach of man, except under exceptional circumstances, and naturally more rarely in the case of gold, the density of which is 19.26, than of silver, which has a density of 10.5. On the other hand, the very constitution of minerals, of conglomerates, or of gold veins brings about, in the beginning, very great prosperity, but an ephemeral prosperity, or at least one of slight duration: witness the exploitations of California (in 1855, production of gold: 336 millions; forty years later, in 1895: 03 millions). The exploitation of silver is more regular, of longer duration, and can be carried out to greater depths. "The time when the silver mines of the world shall be exhausted is, then, so far away that it is useless to think of it, and it is quite certain that the last gold vein will have been long abandoned when considerable quantities of silver are still being extracted" (p. 367).

11,500 feet (3,500 meters) that one has difficulty in doing even ordinary tasks.

Likewise, "Gold has peopled Australia. It is to the discovery of the deposits in Victoria and New South Wales that

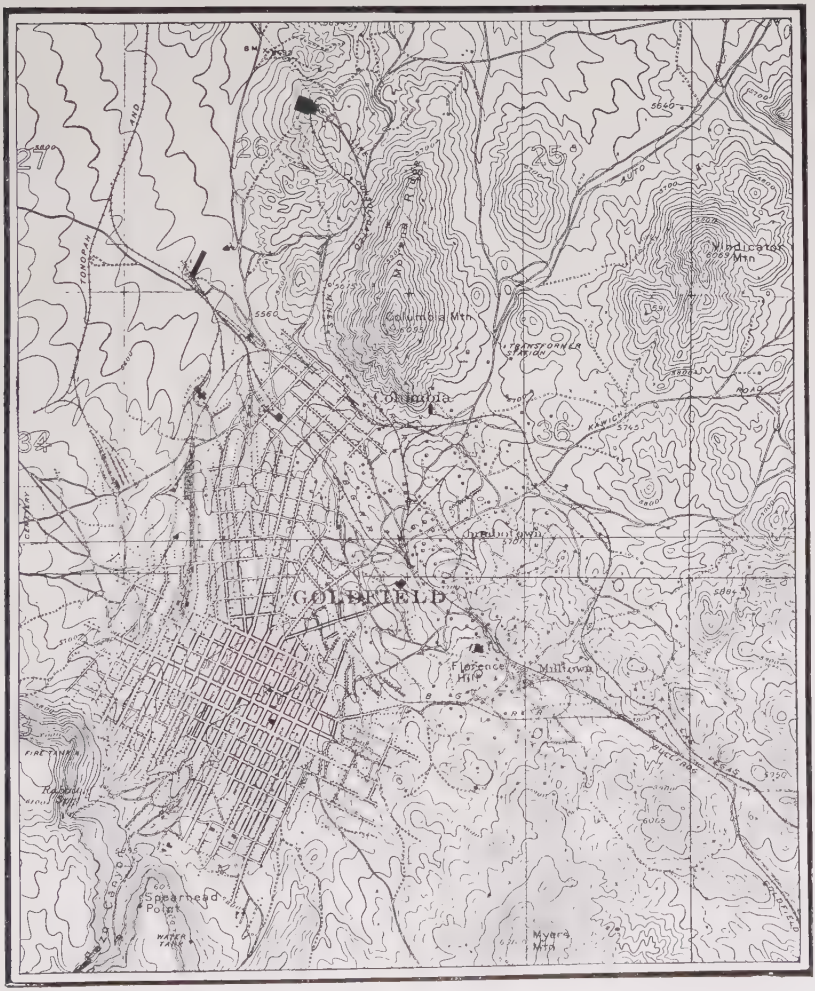

FIG. 144. HOW MINING FOR GOLD MARKS THE GROUND

Portion of the Goldfield Quadrangle, Nevada, U.S. Geol. Survey, showing the intensive type of occupation of the land even in an arid climate, if there exists the stimulus of rich ore deposits.

must be attributed in large part the sudden increase in population which took place in the middle of the nineteenth century (403,000 in 1805; 5,315,000 to-day). About 1890–1892, it was again gold which attracted immigrants into western Australia, the region hitherto the most neglected in Australia."[1]

It is like a scene in fairyland to see this Cyclopean activity appearing suddenly in the midst of the solitude. Take Kalgoorlie for example. On the bare moor rise mills arranged in the form of an amphitheater. The tall iron chimneys throw out smoke and flames, while on all sides strange metallic structures rise like gigantic retorts. Trains wind about, emptying entire forests into the furnaces. Everywhere the subsoil has been burrowed and there are sometimes as many as twenty stories of subterranean galleries. And all around this mining camp the refuse of rocks torn from the depths of the earth forms a girdle of small hills.

Thousands of workmen labor in these mills under the burning sun, blinded and sometimes almost asphyxiated by the smoke, the pulverized refuse of the ores, and the yellow sand of the desert. It must not be thought, however, that these agglomerations are really cities. Two wide streets which cross each other, bordered by a few brick houses, hotels, or stores, form the entire town, but the mining population, from the simplest laborer to the chief engineer, lives about the mine in temporary dwellings: a few huts of wood and more numerous shanties of corrugated sheet iron and canvas, provided with an exterior fireplace. It is a vast camp, a temporary refuge for a population which will scatter when the last veins are exhausted.[2]

Everywhere on the globe gold causes cities to rise out of nothing — Nome and Circle City, Alaska, for example.[3] Cripple Creek became the greatest gold-producing center in the United States; exploitation began there in 1891.[4] Wells

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[1]Bertrand Nogaro, "L'Australie," *Rev. écon. internat.*, July 15–20, 1909, p. 32.

[2]Nogaro, pp. 30 and 31.

[3]Summarizing table of the production of gold in the four chief gold-bearing countries, in 1908 and in 1909 (after the *Statistique de l'industrie minérale en France*, etc., for the year 1908, p. 270; and *ibid.*, for the year 1909, p. 262):

	1908			1909		
	American Tons	Metric Tons	Millions of Dollars	American Tons	Metric Tons	Millions of Dollars
British South Africa	260.47	236.3	157	270.28	245.2	163
United States	159.72	144.9	96	156.74	142.2	94
Australia	122.79	111.4	74	117.61	106.7	70
Russia	46.18	41.9	27	53.68	48.7	32
World production	720.46	653.6	435	731.48	663.6	441

If it is desired to compare this production with that of a number of years ago, read A. de Foville, "La Géographie de l'or," *Ann. de géog.*, VI, 1897, pp. 193–211.

[4]L. de Launay, *L'Or dans le monde*, Paris, 1907, pp. 128 and following.

and prospect holes dot the ground in all directions. Yet the streets of the town end in suburbs that are absolutely barren (see Fig. 144).

4. THE PREËMINENT TYPE OF MINERAL EXPLOITATION ON A LARGE SCALE: THE EXPLOITATION OF COAL

A. General Geographical Inquiry

1. WHAT COAL IS

a) Characteristics.— Coal — rock which burns — is generally of a beautiful and often dazzling black, with glossy fracture surface. Coal is classed according to its external appearance, composition, and especially the manner in which it burns. We distinguish, for example, bituminous coals, which are oily coals rich in hydrogen, and anthracite coals. But we will not discuss here the different sorts of coals. We are studying the coal deposits as a whole, although later, apropos of the geograpnical examination of local deposits, we may mention the influence of the special qualities of certain types of coal.

b) Origin.— Coal is unquestionably of vegetable origin. Between the trees which stand in our forests, and anthracite coal, which is the type richest in carbon, there exist imperceptible transitions through different varieties of peat, of lignite, and of coal. In certain coal specimens we find parts that are already perfect fuel while other parts show by their texture their vegetable origin (stalks, barks, leaves, fruits). Moreover, the microscope shows absolutely that coal is of vegetable origin.

From the geographical point of view it is not without interest to note that a botanical map of the coal periods is not unrelated to the actual distribution of coal and consequently to the distribution of the present human activity associated with coal. The analyses of this mineralized vegetable substance and the minute examination of the coal flora allow us to form a picture of these emerged lands and the neighboring shores in the great periods of coal formation.[1] Though the greater

[1] "The characteristic of the vegetation of which coal was formed was profusion rather than richness, vigor rather than variety. . . . It was an association of large and elegant ferns, above which rose bare tree trunks . . . : the top of this vegetation alone was crowned with sparse foliage, stiff and sharp, which decorated the ends of the topmost branches" (G. de Saporta, *Le Monde des plantes avant l'apparition de l'homme*, p. 45).

number of coal beds known and exploited to-day date from a geological period which takes its name from carbon, the Carboniferous period,[1] coal was formed in several different geologic epochs.[2]

2. WHERE IS COAL FOUND?

The geological map of the globe still has many gaps and we may be certain that coal will be discovered at many points where it is now unknown. We can, however, draw an approximately exact map of the general distribution of coal beds (see Fig. 145).

Such a map might be accompanied by a long commentary. If in Europe the coal beds almost coincide with the zones of production,[3] that is far from being the case elsewhere. Of the two largest coal fields in the world, the one in the United States furnishes the largest quantity each year, while the other, in China, is for the most part still unexploited.

As far as human geography is concerned, coal finds a place in our studies only from the moment that man becomes associated with it by wishing to make use of it. It is because man wishes to use coal that he becomes dependent upon it; and it is therefore by a rapid examination of what man does with coal

[1] Émile Haug, in his excellent *Traité de géologie*, has united under the single name of the *période anthracolitique* the Carboniferous and the Permian, after the example of W. Waagen (II, pp. 743 ff.).

[2] There are at Tonkin, for example, some coal deposits of the Jurassic age (Rhetian period). See R. Zeiller, "Flore fossile des gîtes de charbon du Tonkin, Min. des trav. publics, *Études des gîtes minéraux de la France, Colonies françaises*, Texte, Paris, 1903. "There is some of it [coal] in the Cretaceous, in the Tertiary — in a word, at every step of the geologic scale. The coal fossils of Fuveau (Bouches-du-Rhône) are remarkable for the clearness with which they belong to a water course which carried the granite of Maures and the porphyry of Esterelle into a great expanse of fresh water, reaching from the Var to the Hérault, an ancient marine gulf which had become separated from the sea and turned from salt to fresh water. Crocodiles, turtles, thousands of river shells, have left their remains in this lignite. Mammals certainly existed, for we know the most ancient of them, but they have not yet been found at Fuveau. The flora was already rich in phanerogamia in this latter part of the Cretaceous era. At Manosque (Lower Alps) coal was formed toward the middle of the Tertiary period; cryptogamia and even gymnosperms are decidedly relegated to a second place; oaks, laurels, camphor trees, cinnamon trees, myrtles, legumes, aralias, magnolias, palms, dragon trees, made a covering of abundant and varied foliage sprinkled with bright-colored flowers and filled with soft, sweet odors. Turtles, crocodiles, and mammals similar to our hippopotamus — the anthracotheria — wallowed in the grass on the banks of the streams. In the dry regions, other mammals — already very diversified — cropped the grass or fed upon their prey, while the birds called in the woods or flew over the waters" (Collot, *Combustibles fossiles*, Dijon, 1901, p. 11).

[3] Yet the basin of southeastern England and especially the basin of Campine, recently discovered by means of sounding, ought to show coal zones yet untouched, as well as evidences of basins now in the process of exploitation.

that we shall be able to grasp the true connections which exist on the earth's surface between coal beds and human facts.

B. The Use of Coal by Man

Coal has existed where it is since there have been men upon the earth, but it had no influence upon man so long as he did not know how to take advantage of it. As soon as man had need of coal and in so far as coal could satisfy the needs of human activity, men came, at certain points of the globe, under the influence of a localized attraction and the human geography of coal began.

The Chinese knew coal at a very early date. The Greeks also knew it, and Theophrastus, in his *Treatise on Stones*, speaks of the *Lithanthrax*. Doubtless some blacksmiths, because of lack of wood, employed mineral carbon, but this was only a very restricted use, and the Romans seem to have made still less use of coal.

In the Middle Ages we find some traces of exploitation, notably in the basin of the Loire, in the neighborhood of Roche-la-Molière (Forez). A document of 1321 bears the statement that the lords of the district of the Loire had laid claim to a tax on all the coal mines of their territory. In England the coal fields of Newcastle are mentioned as early as 1066. But there, as in Belgium, the attempts at exploitation were very limited. Not only was coal not sought after, but it was feared. When the tradesmen of London had recourse to coal in the fourteenth century, the nobles and the middle classes protested, and Edward I severely punished anyone who introduced coal into the cities. Similarly in France under Henry II the farriers of France were condemned to fine and imprisonment.

As the industrial movement slowly developed and doubtless also as wood became more scarce, coal was used to a certain extent, but all these fragmentary historical data represent nothing, as a general geographical fact. Indeed it is only with the end of the eighteenth century that we see the sudden advent of coal as an economic factor.

Coal owes its arrival as an economic factor to steam and iron: *to steam*, because it became the great fuel for producing

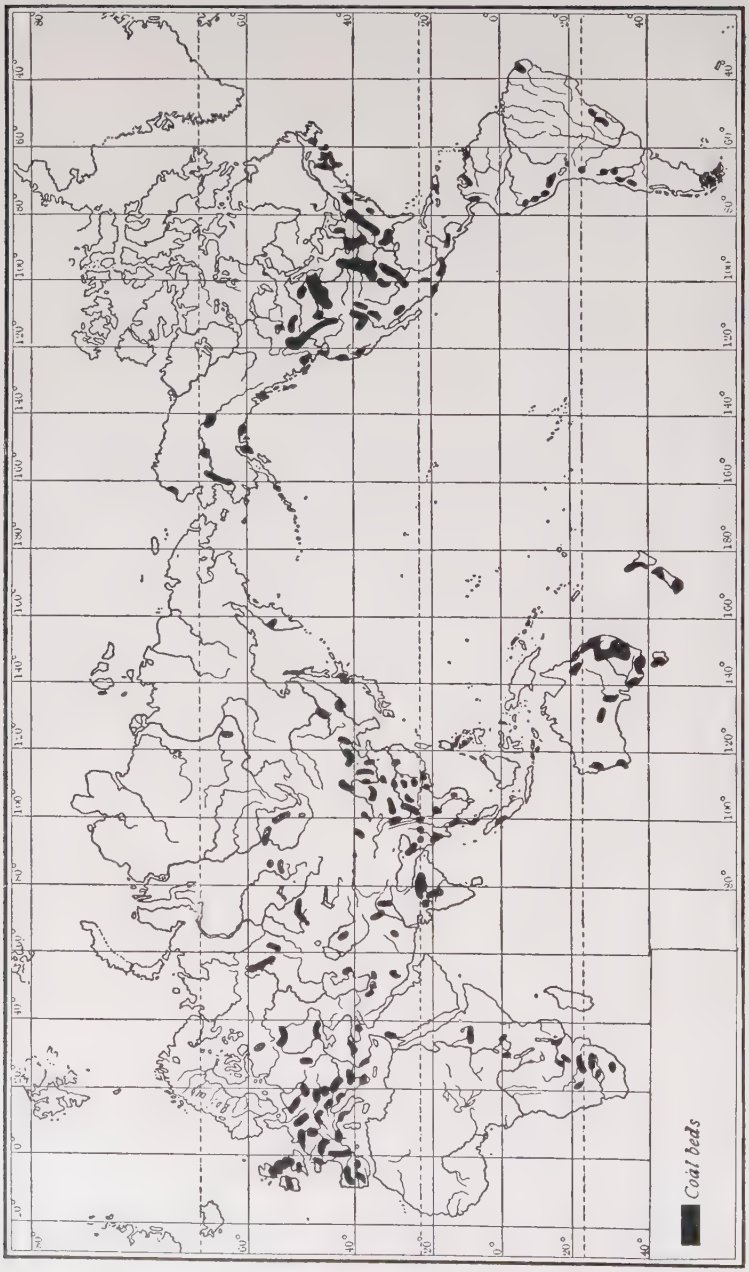

FIG. 145. THE GEOGRAPHICAL DISTRIBUTION OF THE COAL BEDS OF THE WORLD
The map includes lingites as well as low-grade and as yet unprofitable coal deposits

it; *to iron*, because it became the great fuel for preparing it.

The century of iron and steam has been the century of coal, and one may equally well say that if the nineteenth century had not been the century of coal it would never have been the century of iron and steam.

At the end of the eighteenth and at the beginning of the nineteenth century there was an astonishingly converging series of events: Iron ceased to be used exclusively for the manufacture of arms and locks and began to be used for building; it was required therefore in large amounts, and we have the prelude to those daring works which reached their highest point with steel. On the other hand, steam furnished a new motive power; and the union of iron and steam brought about the complete transformation of transportation.

These five dates, taking the place of long expositions, show very strikingly the birth of the new industrial age:

1779: First iron bridge over the Severn at Coalbrookdale; beginning of metal structures.

1785: First application of the steam engine to the manufacture of cotton (Manchester).

1801: Lebon in France obtains illuminating gas from coal.

1819: First crossing of the Atlantic by a steamboat, the *Savannah*, from Savannah to Liverpool, in 29 days.[1]

1825: First railroad from Stockton to Darlington (England); first locomotive for passenger service.

Coal is not the cause of all the industrial revolution but, until the advent of "white coal" at the end of the nineteenth century, it was the necessary condition of it.

And now we shall show what is done with coal.

I. INDUSTRIES WHICH USE COAL

a) Metallurgy. – The metallurgical industries are the great consumers of coal. The development of iron and the development of coal are not merely parallel but, as we shall see, closely connected. It would be well to recall here the multiform

[1] See P. Camena d'Almeida, "Le Centenaire de la navigation à vapeur 1807–1907," *Correspondant*, August 25, 1907, and separately, *Institut colonial*, Bordeaux, p. 10. It is a discussion of the voyage of Fulton's *Clermont*, on the Hudson, from New York to Albany (1807), the centenary of which was celebrated with good reason; but this voyage had no immediate economic and commercial results.

development of metallurgical industries. Iron construction finds one of its most representative realizations in railroads which have locomotives, cars, and tracks of metal.

Now about three tons of coal are required to reduce one ton of iron ore; it then takes not less than four or five tons of coal to transform pig iron into iron or steel. Metallurgy therefore calls for a very large consumption of mineral fuel.[1]

b) Other great industries.— Let us simply mention the textile and glass-making industries, which use coal as a fuel. It would be well to note further the part played by coal in many industrial preparations such as the manufacture of soda, the concentration of sulphuric acid by the Kessler process, etc.

c) The transportation industry.— In France the railroads alone consume an amount of coal that varies between 7½ and

[1]In studying iron ores and the metallurgical industries, it is important always to bear in mind the same geographical ideas of localization and connection; see, for example, the book by Georges Villain, *Le Fer, la houille et la métallurgie à la fin du XIX^e siècle* (Colin, Paris). We recommend especially the studies devoted, in 1895–96, by the *Rev. gén. des sciences* to French metallurgical industries, in the series of scientific and industrial researches; these articles are accompanied by very well-made maps. See, for example, in the year 1895, E. Demenge, *État actuel du travail du fer et de l'acier*, pp. 922, 924, 926, 927, and 928, with schematic maps representing the distribution of French foundries in their relation to the coal beds; and in the year 1899: A. Pourcel, *L'État actuel de l'industrie de la fonte en France*, pp. 511–515, with maps representing the distribution of iron minerals in the different parts of the world. There is a discussion here of the connection between metallurgy and coal. For the most recent bibliography of iron deposits, see above, the notes on chap. V, §1. Nothing shows better in what real and complicated forms the local and regional connections between coal and iron present themselves than this passage taken by way of example from the remarkable study devoted to "Régions françaises" by P. Vidal de la Blache in the *Rev. de Paris*, December 15, 1910, pp. 835 and 836: "The region of Lorraine set forth a quarter of a century ago, at full sail, upon the sea of industrial life. In spite of the remarkable progress, in this period, of the textile industry in the Vosges, the transformation is due especially to the extraordinary importance to which iron has attained in modern civilization. The systematic extraction of oölitic ore from the hills of Lorraine had begun as far back as the last years of the reign of Louis-Philippe, but its phosphorous nature made it unfit for the manufacture of steel. The discovery, in 1880, of the process of dephosphorization suddenly changed the state of the market; Lorraine became, in fact, one of the chief mining centers of the world. While production still increased around Longwy and Nancy, soundings directed by geologists in the neighborhood of Briey revealed the existence of the same deposits over an extent of more than 100,000 acres. Already the iron of Lorraine, which, in 1878, counted for only half the iron production of France, to-day represents nine-tenths of it; and it is prophesied that in a few years the single district of Briey will put out 20 million tons. How is this prodigious mass to be exploited in a normal way, without disastrous risks, in a country which has no coal and which lacks labor? To the first question science has given an answer: methodical investigations organized by the Association of the Coaling Societies of Lorraine, in 1904, revealed, at a depth of from 2,000 to 3,000 feet, the prolongation of the coal vein of Sarrebrück at the very place where the position of the anticlinals had made it possible to foresee that these veins would approach the surface. This is perhaps not enough to render it independent, but it may eventually serve toward that end." See also, on the same point of view, Th. Laurent, "Le Développement économique de la France, l'industrie métallurgique," *Musée socialé, Mémoires et documents*, April, 1912 (Rousseau, Paris), and F. Sauvaire-Jourdan, "Un Conflit dans la métallurgie allemande," *Rev. politique et parlementaire*, No. 206, August 10, 1911.

8 million tons, that is, about a fifth of the total production (40,513,934 tons in 1908).[1] Steam vessels represent an ever-increasing consumption.[2]

d) Domestic use.— For France the domestic consumption of coal equals at least a quarter of the total production.

One may see from these few brief indications that for a country such as France the production does not equal the consumption. According to one of the recent volumes of the *Statistique de l'industrie minérale et des appareils à vapeur en France et en Algérie*, published by the Minister of Public Works, a volume which refers to the year 1909, the production of coal was 41,711,032 tons and the consumption 62,119,015 tons. The production therefore provided for only three-fifths of the consumption.

We should add that the coal fields themselves use much coal directly — nearly 5 million tons.

2. THE INDUSTRIAL OFFSPRING OF COAL

Coal is not used merely as a necessary condition of a great number of industries. It has itself given birth to a series of industries that we may rightly call the "offspring" of coal.

It is true that the full effect of Lebon's discovery in 1801 was not felt immediately. "It required long effort and the intervention of the King, Louis XVIII, to triumph over prejudices which opposed the substitution of gas for the older lighting by oil."[3] But, since that time, how the problem has changed! Formerly coal was treated to obtain illuminating gas. All that remained, even the coke, was waste. To-day it is the other way about; the residues have

[1] *Statistique*, etc., *pour l'année 1908*, Imp. nat., Paris, 1909, and *idem*, *pour l'année 1909*, Imp. nat., Paris, 1910.

[2] "Day by day greater speed is desired, and, all other things being equal, the consumption of coal increases as the cube of this speed; that is, if they want to advance from 10 to 20 knots an hour—or simply to double the speed—it is necessary to use eight times as much coal and to find room enough to store the corresponding weight. Hence the high price of rapid transportation; *time is money*. The smallest steamers of the Netherland Line use over 55 tons a day, about 2¼ tons an hour; those of the Inman Line and of the White Star Line from 110.23 to 121.25 tons. The large steamers, such as the *Etruria* or the *Umbria* of the Cunard Line, and the *City of Rome* of the Anchor Line, use daily 325 tons of fuel. The *City of Paris*, at the limit of its power, attains the frightful consumption of 529.11 tons a day, or 22.046 tons an hour, 1.102 tons in three minutes, 10 lbs. (5 kil.) in 15 seconds" (H. de Parville, *Causeries scientifiques*, 31st year, 1890, Paris, 1895, pp. 309–310).

[3] Jules Gay, "L'Acétylène," *Quinzaine*, April 15, 1897, p. 555.

acquired such a high industrial value that gas would be manufactured even if it should no longer serve for lighting. In fact, the industrial productivity of coal is practically incalculable, since from it are obtained the coal tars with their by-products: benzine, naphthalene, coloring matters, artificial perfumes, and even pharmaceutical products such as sulphonal and antipyrine.

Let us sum up in a few lines the derivatives obtained from coal by dry distillation:

1. Coke, mingled with carbon and other mineral substances which form in certain cases a much prized fuel that burns without smoke.

2. Gases (formalin, acetylene, hydrogen, carbon dioxide, carbonic acid, azote, sulphureted hydrogen, vapors of sulphur and of carbon, salts of ammonia, and carbureted hydrogen). These gases may be used as a very economical motive power.

3. Ammoniacal waters. Ammonia is thus obtained from coal and the industrial and agricultural uses of ammonia increase: for freezing, the manufacture of sulphate of ammonia as a fertilizer, etc.

4. The prussiates and cyanides from which Prussian blue, for example, is obtained.

5. Finally, those marvelous compounds, the coal tars, from which come alizarin, which has replaced madder, phenol or essence of bitter almonds, etc.

What are the geographic consequences of the development of the industries which are the offspring of coal?

They are first of all some indirect and negative consequences which have a remote, but strong and very powerful, influence, showing itself in certain geographical facts such as the disappearance of cultivation from an entire region (madder), or the suppression of all the commerce associated with camel's dung, from which ammonia was formerly obtained.

The direct consequences are, from the geographical point of view, less important than one might at first suppose. A remarkably fruitful industry in coloring matter has developed, especially in Germany, i. e., in one of the great coal-producing countries. That is, however, a general connection which does not cause a direct localization of the new industry on

the coal bed. Likewise, illuminating gas is manufactured for use in cities, and this industry is in a certain measure independent of the coal regions. In short, all that group of industrial facts which arise from coal are much less dependent upon it geographically than economically, logically, or historically.

What, on the other hand, are the geographical consequences of the rise of industries which use coal?

Coal is a heavy product that cannot be transported far from the original beds without great expense, and, since certain industries need coal in large quantities, the industrial establishments have necessarily been brought close to the coal fields. This is an essential connection which was almost tyrannical at the beginning of the modern industrial movement but which tends to lessen as the development of means of transportation, aided by coal itself, allows a wider diffusion of this fuel. This connection remains, however, the most important fact in all the human geography of coal. We have seen the profound reason for it and we shall now study its manifestations.

From the point of view of strictly geographical method we should note very carefully this distinction between the logical and industrial connection and the geographical connection. When coal is used as *raw material*, the industries proceeding from it are less dependent upon the earth and are less fixed to a certain point on the surface. When coal is used as a *fuel*, the industries making use of it are more dependent upon the coal regions. Thus, for the geographer, there is a closer bond between coal and the industries which exploit it as a fuel or motive power than between coal and the industries which treat it as a raw material.

C. New Geographical Facts

1. the coal mine

A subterranean world, composed of hundreds of feet of shafts, miles of "galleries," hundreds of "cuttings," is the chief type of the great mine. Coal is a product that is required and consumed in large quantities; it is consumed without being subjected to any special treatment; it is completely used up and the supply must be constantly renewed. For these

three reasons the holes made in the earth are larger than for any other sort of mining; only a few salt or copper mines can be compared with coal mines. They have depths that reach 2,600, 2,950, or 3,280 feet (800, 900, or 1,000 meters).

In spite of the very hard conditions of the miner's work there are other sorts of industrial labor still more exhausting. We wish to emphasize, not the difficult character of the coal-cutting, for example, which the miner must often do lying down, crouched in a very small space, or stretched out upon damp and muddy ground, but the general characteristics as a whole which result from the dimensions and from the material and geographical conditions of the coal mine. It is because of the number of forces against which the struggle must be carried on every hour and every moment that the accidents which occur are sometimes veritable human hecatombs: the catastrophe of Courrières (March, 1906) with its 1,100 victims will serve as an example.

On the whole, life in the depth of the mines is of such a character that certain endemic diseases develop which have long been grouped and hidden under the blind expression "miners' anæmia." The race is atrophied; a miner's child may be recognized by its sickly look. The women have too long been permitted to work in the depths of the mines.

2. THE AGGLOMERATION WHICH IS THE SURFACE APPENDAGE OF THE MINE

On the whole, the mine is a veritable territory, but it is a territory which man cannot inhabit. Some few horses and mules are the only living beings that go down into the mine once for all, never again to see the light of day. The mine workers live on the outside. The journey to the working place is so difficult and so long that this population connected with the mine must be lodged as near as possible to the shafts. There is thus created near the openings of the mine a sort of artificial city, with houses exactly alike, which are the "result" and the necessary "sign" of the work underground.

It is becoming more and more possible, however, for this type of uniform and, so to speak, amorphous agglomeration to be placed at a great distance from the shafts, and the

working population is then brought to its work by special trains running upon special tracks.

3. THE URBAN INDUSTRIAL AGGLOMERATION

As we have said, other industries group themselves around coal. Let us see what are the surface facts which result from this connection.

Coal — in small or large quantities — is like the protoplasm around which develop industrial construction, circulation, and life. On the Podèze, near Lausanne, is a small vein of lignite once exploited and later abandoned because of the competition of foreign coal. But beside the coal are clay deposits; in 1896 a cement factory was installed nearby, farther downstream. This factory took up again for its own use the exploitation of the vein of lignite, and also worked the clay; having both fuel and clay, it had only to bring in the lime. The vein of lignite is now no longer sufficient, and the factory brings in other fuel from farther away. Nevertheless it is true that the isolated vein of lignite was the determining cause of the small industrial unit situated beside it.

In directing itself upon miniature facts, geographical observation gets a better grasp upon the colossal reality of the connections which have determined the industrial agglomeration of to-day — an agglomeration of factories of every sort brought together by the common fact of the exploitation of coal — monster cities busy day and night, cities whose atmosphere is vitiated by the smoke emitted from a forest of chimneys, some among them rising to a height of more than 300 feet.[1]

In the beginning of this book we declared that every form of human labor found expression in facts of habitation and forms of installation. They are, as it were, fixed and material "projections" of that which occupies the mind or the muscles of men. No chapter of cultural or industrial geography can be complete unless we further consider the way in which these

[1]The atmosphere of great industrial cities is much more vitiated by the smoke than one would think. Paris, as is well known, is a great industrial center; her 1,950,000 chimneys send out yearly about 300,000 pounds (160,000 kilograms) of soot, and one can imagine all the carbon dioxide carried in the air which is breathed (see the report of Gautier to the Academy of Sciences, March 21, 1898).

types of activity express themselves through the "house" and aggregates of houses.

Coal has given the impulse to excessive industrial concentration and it must be regarded as the responsible cause of the industrial agglomeration, even when this is far from the coal bed. We must in fact distinguish two chief types of industrial cities: the great city born above and from the coal, and the great historic city which was powerful enough to summon coal to it and to transform itself into an industrial center in spite of its distance from the coal.

There is always a difference of appearance between the two. The first is a sort of vague being, an invertebrate body, to which cells are unceasingly added; it has no precise center; its life comes from elsewhere and goes elsewhere. It is never alone, it forms part of a whole; there are other similar groups all around it; it belongs to a zone of industrial agglomerations, but it does not constitute the zone in itself, as does the second type, the historic city, such as Paris or London.

The first type as it develops joins other centers likewise developing. The fundamental kernel is not the city, but the zone which, when it reaches the point of saturation, will be covered with an almost even and continuous layer of population.

The second type, from its historical origin and in spite of the vicissitudes of its new life, retains a principle of unity and plays the part of a true center of attraction. It goes on developing and swallows up its suburbs. It has a center. It is not one long street like Saint Étienne. And, curiously, it further causes emptiness in a great circle around itself. If it does not depopulate certain small cities, it deprives them of their logical and natural growth. Within a radius of more than 60 miles (100 kilometers) of Paris there is not a single city of 50,000 souls. The same thing seems to be true of London and Berlin. An urban center near Manchester, Newcastle, or Düsseldorf will, like those cities, have the chance of growing. An urban center near Paris or London will be likely to remain stationary, unless it be very close and grow by direct and immediate contact with the central agglomeration — unless it be situated precisely in its zone of extension.

For how long a time did Passy, Levallois, etc., remain little

villages until Paris, reaching and joining them, communicated to them her vitality, her power of growth! These little cities so close by, not having within themselves a principle of life independent of the historic tradition and the acquired force of the central agglomeration, live the new life only when they are themselves within the ever-growing circle of the whirlpool.

The great city may even become empty at its center, a fact which may be verified at Paris or at London. This is not a question of an ephemeral and exceptional fact, but of a fact of urban geography that is becoming more and more general. A German author has given to this phenomenon the name of *Citybildung*, formation of a city (London); he shows that this progressive diminution of the centers of great cities dates only from the middle of the last century.[1] Up to the year 1901 the *city* of London lost 118,000 inhabitants, that is, four-fifths of the maximum population which it had possessed. The center of Paris lost 90,000 inhabitants, or two-fifths of the maximum. The *Altstadt* of Berlin lost 30,000, or half of the maximum. In Vienna the phenomenon seems to have been perceptible only since 1871, but it becomes more pronounced day by day. In New York the density of population in wards 1, 2, and 3 of Manhattan Borough, the "center" of the city, is almost below city grade.[2]

In spite of the profound contrasts between the industrial and the historic city, there are very many traits common to the two types. For example, both give rise to the large house. The people crowd together and the houses, being unable to spread out in width, rise in the air to form the tenements of the great factory cities.

4. THE INDUSTRIAL ZONE

The industrial city, as we have described it, shows us at the same time what this strip or spot of industrial life is which

[1]Hermann Schmid, *Citybildung und Bevölkerungsverteilung in Grossstädten, Ein Beitrag zur Entwicklungsgeschichte des modernen Städtewesens*, Reinhardt, München, 1909. At the end of his article, "The Evolution of Cities," *Contemporary Rev.*, February, 1895, pp. 246–264—an article which also contains a number of ideas and observations which might be questioned—Elisée Reclus has called attention to this fact; but its importance should be further emphasized.

[2]See again Mark Jefferson, "The Anthropography of Some Great Cities, A Study in Distribution of Population," *Bull. Amer. Geog. Soc.*, Vol. XLI, 1909, No. 9, pp. 537–566 and 10 figures.

marks on the surface of the globe the subterranean coal veins. The general aspect is that of the famous "Black Country" of the center of England: neither verdure nor running water; blackish canals, gray houses, roads strewn with black slag, a gray and heavy atmosphere, and everywhere smoke.[1] With their great "terris," they seem at first sight veritable countries of ruins: they have their mournful coloring, very often their aridness, and always their sadness.

Nothing could better represent the common character of these zones of industrial concentration than the very expressive map, made up of small maps combined, which is found on p. 93 of the Vidal-Lablache Atlas, *Régions industrielles de l'Europe*. The author has brought together upon a single page, maps on the same scale (1:1,000,000) of the main industrial regions of Europe in order to show, by the very obvious comparison, certain general economic facts. The map of Fig. 146 is a specimen of one of these industrial strips or zones of Europe.

The creation of these types of new population has not gone on without bringing about a large number of geographical facts which we should later examine from the regional and local point of view:

a) Depopulation of the country districts as a result of the attraction of the centers of new life that have sprung from coal.

b) Development and accumulation of ways and means of communication of all sorts.

c) The rise of entirely new urban centers and consequently the population of regions hitherto uninhabited: the region of Birmingham, plateau of Tarnowitz, region of Montceau-Blanzy, creation of Middlesborough in the mountains of Kentucky.[2]

d) Displacement of the historic and economic poles of activity:

For cities: Newcastle, the great coal city, becoming a very important center, while in other countries cities which have no coal and which do not become industrial cities lose their rank

[1] In certain coal regions, especially where the coal is found at a great depth, as in Pas-de-Calais, the surface is used for rich industrial cultivation, such as the raising of beets.

[2] Max Leclerc, *Choses d'Amérique*, Armand Colin, 1897; chap. I, "Comment on fonde une ville."

and influence: Constantinople, which has not a single factory chimney, was in 1870 the third city in the world; it is to-day only the twelfth or thirteenth.

For countries: Displacement of activity in England to the profit of the coal zone (see farther on). Growing importance of the South in the United States. Great power acquired by the part of Europe where coal is found to the detriment of the countries of older culture on the Mediterranean.

Coal has been the most active of the determining causes of urban centers and of what might still better be called urban strips or zones (see Figs. 147 and 148).

D. Regional Geography of Coal

In a complete book on coal, here would be the place for a study of all the regions where coal is exploited. It goes without saying that such a study would take us too far afield.

By a quick sketch of the geography of coal in two great European countries, Great Britain and Germany, we shall indicate in what spirit such inquiries might be conducted.

1. COAL IN GREAT BRITAIN[1]

During the entire nineteenth century and up to 1899, Great Britain was the country which produced the most coal. If the production in the United States is greater to-day, the geography of coal in the English regions remains none the less of captivating interest, for the new industrial facts have there been superimposed on and mingled with a very old historic life and geography.

England has about 3,500 mines under exploitation, employing 960,000 workmen, so that we may estimate the number of persons living by means of coal at three millions or three millions and a half.[2]

[1]See particularly E. Lozé, *Les Charbons brittaniques et leur épuisement: Recherche sur la puissance du Royaume-Uni de Grande-Bretagne*, Béranger, Paris, 2 vols., with maps, plans, cuts, and graphs.

[2]This number of 960,000 persons employed in the coal mining industry in the United Kingdom is given by the official English *Coal Tables*, so that at the time of the great strike of English miners at the beginning of the year 1912 one could speak correctly of "a million men on strike." The same document gives, as the number of persons employed in the production of coal in other countries, the following figures: United States, 690,400; Germany, 591,000; France, 191,000, and Belgium, 145,300. The great miners' strike which occurred in England has shown better than all written documents the fundamental rôle of the coal industry.

FIG. 146. HOW THE DEVELOPMENT OF AN INDUSTRIAL REGION MARKS TI

The main facts of human establishment in this small section of the basin of the Ruh

Between the two industrial centers of chief importance, Essen and Bochum, the hou and tending to become what we call an "industrial zone."—Notice the almost regular al meandering valley of the Ruhr. In this region, formerly almost all forested, the building c though the general outline can still be traced on the two banks of the river. The only r network of lines.

FACE OF THE GROUND. AN EXAMPLE FROM THE BASIN OF THE RUHR

taken from the two sheets, *Essen* and *Bochum*, of the German map, 1:25,000.

ease in number, and the little groups of houses approach one another, nearly meeting t of the centers of secondary importance (of the type of Steele) on the sides of the s caused the trees to be cut down; the forest has become more and more cut up dicated on the map by black lines, are the railroads, which already present a crowded

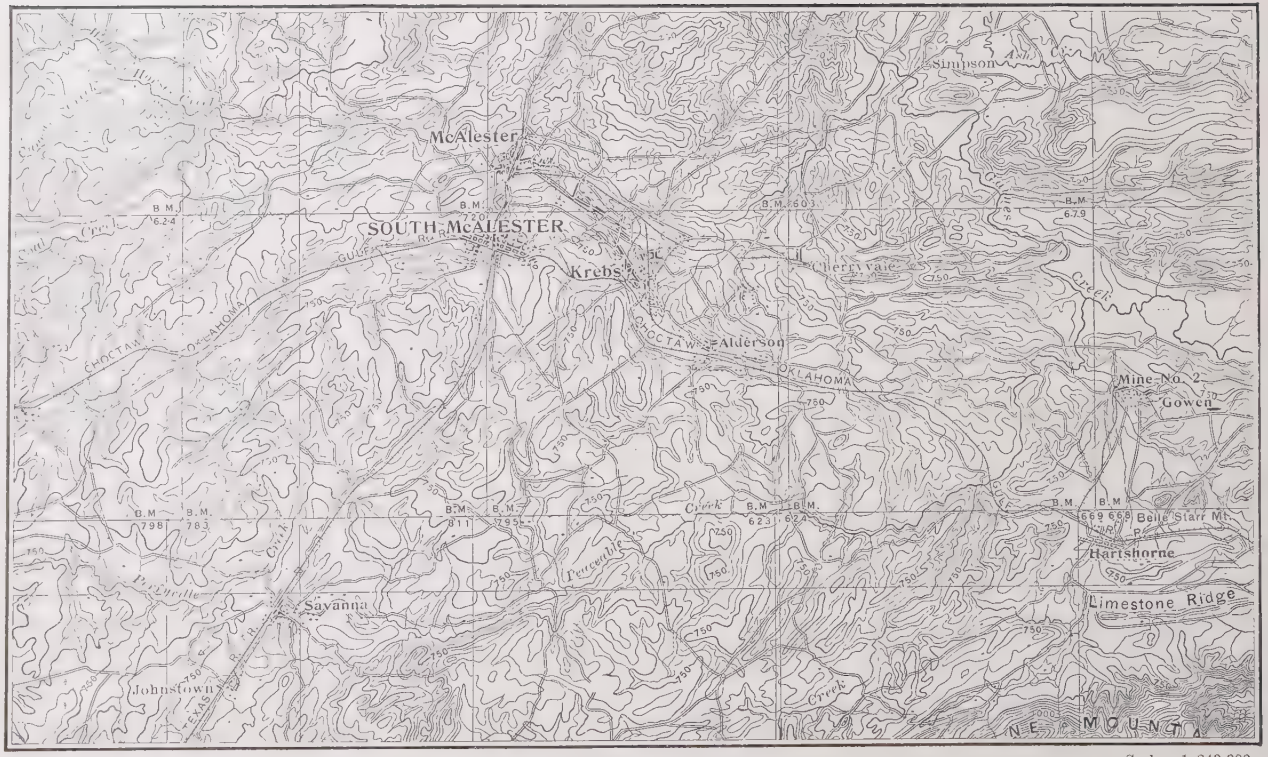

FIG. 147. A PART OF OKLAHOMA (THEN INDIAN TERRITORY) BEFORE DEVELOPMENT OF THE OIL. THE POPULATION IN 1898

A section of the topographical sheet, scale, 1:125,000, of the U. S. Geological Survey, Indian Territory (Choctaw Nation) McAlester Quadrangle, edition of Aug., 1898. In Fig. 148, the same section illustrates the growth of population in eleven years.

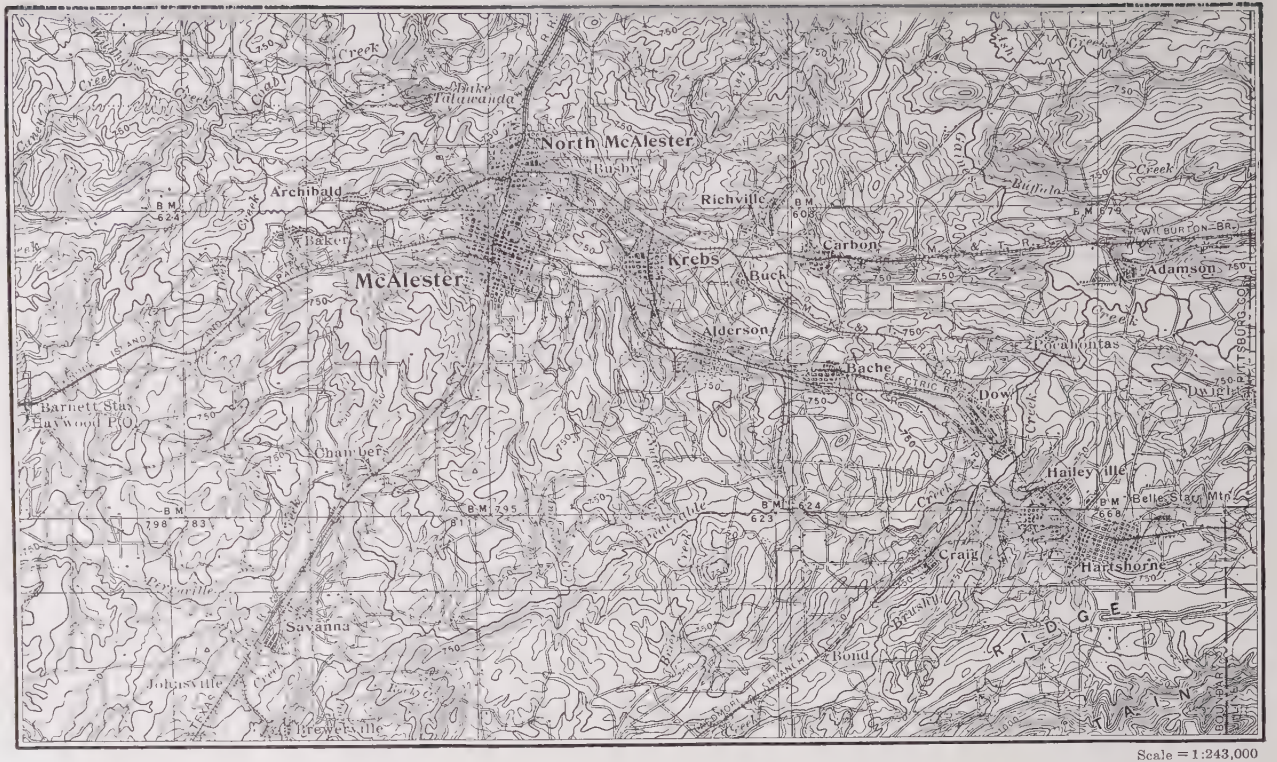

FIG. 148. ELEVEN YEARS LATER. THE POPULATION IN 1909. THE EFFECTS OF THE DEVELOPMENT OF THE OIL

The edition of September, 1909, of the same sheet (Fig. 149) enables us to compare accurately the wonderfully rapid development of the urban population with the situation in 1898. McAlester has become a large agglomeration with suburbs; an urban zone extends from McAlester to Hartshorne with small centers, like Bache, forming spontaneously.

The total annual production of coal in the United Kingdom is five tons and a half per inhabitant. If we deduct from the total the coal which is exported, the coal employed for the manufacture of exported cokes, as well as the coal known as bunker coal used for British and foreign ships, we find that the home consumption is four tons per head, the largest consumption in the world.[1]

The coal beds of England have in general the advantage of being deposited in regular layers with little barren rock; also, the coal deposits are often found near the sea or near a navigable stream.

Where are the mines of Great Britain situated? In England there are two Englands: the old worn highlands of the north, the center, and the west, and the great Tertiary or London basin of the southeast. It is in the southeast, green with its woods, its meadows, its evergreen hedges, so harmonious in outline and color, with peaceful rivers, that all historic England has developed. In the mountainous region, a rough country with a hard climate, the inhabitants, down to the eighteenth century, were pure mountaineers.[2]

Coal has naturally been deposited and distributed upon the periphery of the ancient plateaus: (1) the northern coal field; (2) the central coal field; (3) the coal field of Wales; and finally (4) the Scotch coal field in the narrow neck of land which separates the mountainous regions of the north of Scotland from those of the south (see Fig. 149).

1. *The northern coal field.*—This is the most important field and the most distinctly a *coal* field, with an annual production equal to that of France and Belgium together (45,000,000 tons)—a region of 30 miles (50 kilometers) between

[1] According to E. Lozé, in the *Économiste français*, June 11, 1904, p. 854.

[2] "In the Middle Ages we used to content ourselves with shearing our sheep and selling their wool to the men of Flanders, who had become the cloth manufacturers of Europe. . . ." (Thorold Rogers). "At the beginning of the 17th century, the English are still—and more so than any other people of civilized Europe—a sedentary society, agricultural and pastoral, who tend to become more pastoral than agricultural" (Boutmy, quoted in Max Leclerc, *Les Professions et la société en Angleterre*, Armand Colin, Paris, 1894). In order to understand the progressive growth in the transformation of England, one should read the authoritative book by Paul Mantoux, *La Révolution industrielle en Angleterre au XVIII^e siècle, Essai sur les commencements de la grande industrie moderne en Angleterre*, E. Cornély, Paris, 1906. The author shows the series of industrial changes that preluded the coal era in England, and the extent to which the previous efforts—mechanical and commercial—explain the development of the 19th century.

the Tees and the Tyne, which lives exclusively by means of coal. On the Tees, up which the tide mounts 12 miles (20 kilometers) from its mouth, are the ports of Stockton and of Hartlepool, each being a type of city which owes its entire existence to coal (in 1840 there was not a single house). On the Tyne, to the left, is Newcastle (to-day 276,000 inhabitants), the real mistress of the coal zone, a typical coal city with an immense port of 11.7 miles (19 kilometers), joined to Gateshead on the right bank by the Stevenson viaduct, 7 miles in length. Sometimes 300 vessels loaded with coal leave the mouth of the Tyne on a single tide.

FIG. 149. THE DISTRIBUTION OF THE COAL FIELDS AND THE INDUSTRIAL REGIONS IN THE UNITED KINGDOM

The darkest areas are the coal fields. The greater part of the industrial activity is concentrated in the vicinity of the coal: I, iron; L, lead; C, copper; Z, zinc; T, tin.

Figures 149 and 154 are from the handbooks of Busson, Fèvre and Hauser, Félix Alcan, editor.

The attraction exerted by coal upon other industries: the celebrated Armstrong establishments, the equivalent of the Krupp factories in Germany and the Creusot factories in France, are situated on the left bank of the Tyne between the coal of Newcastle and the iron mines of Cleveland, but nearer to the coal (they cover 79 acres and employ more than 16,000 workmen).[1]

2. *The central coal field.*—Here the phenomena are more complicated: a very ancient industrial activity has been increased and modified by coal.

Staffordshire: The coal comes to the level of the ground.

[1]See Colonel X . . . . , "Les Établissements Armstrong, leur origine, leur situation actuelle," *Rev. gén. des sciences*, March 15, 1897.

No verdure, no cultivation; the activity in coal has devoured the land; this is a typical example of the "Black Country," of which we have already spoken.[1]

In 1696 Birmingham was a town of 4,000 inhabitants, surrounded by moors where the fox was hunted; to-day, with its 860,000 inhabitants, it is the great iron and steel metropolis, entirely surrounded by industrial cities such as Wolverhampton (106,000 inhabitants) to the northwest, the city of foundries, hardware, and lock-making.

Yorkshire: A remarkable type of a coal field which has become a great industrial center with a tendency to specialization; Leeds, the leading wool city (457,000 inhabitants).

Lancashire: Yorkshire coal is brought from Manchester to Leeds by the great canal built in the first quarter of the nineteenth century. On the other hand, Manchester has become a seaport by the construction of the Manchester Ship

[1]Commenting on this book in an article in the *Gazette de Lausanne*, April 1, 1912, J.-El. David described in a very personal way the "Black Country" and the contrast between historical and industrial England: "Formerly, beyond the England of history, the England which stretches to the south from Worcester to Cambridge, there was an England of forest and heath, of pastures and marsh, broken only by some few ancient cities huddled around a sanctuary or the ruins of Roman *castra*—York, Chester, Durham, Leicester, Peterborough, Shrewsbury, bordering the country of Wales. A train leaves for Oxford; let us take it. The little hills of Shropshire, looking like mountains with their mantle of woods, quickly give place to level land. Under the fine turquoise sky, in the shade of clumps of oak trees, the cattle browse or chew their cud.—A shadow passes; then another, denser; still another joins them, and a cloud of soot bursts into the coach. The horizon bristles stiffly into vertical bars above which wave black plumes. The earth billows into heaps of crumbling, smoking débris. An atmosphere like a tunnel, acrid odors, invade the coaches. Through the windows, hastily closed, one sees little brick houses filing past—all exactly alike and colorless. Enormous letters placard the front of massive buildings: *Works; Manufacturing Co.;* industrial names known throughout the world may be read, with obscure ones as well. Not a tree, not a spear of grass. Hills of slag, mounds of coal, careful piles of materials, blackened railroad stations, branch lines forking in every direction; panting engines, long trains that follow or pass each other; drawbridges, cranes, reservoirs, sheds—yawning empty or filled to overflowing—cables where a scoop hangs, runs up, balances, and slides down again. At intervals, a glimpse of a street, the end of which is swallowed up in thick gloom, a narrow corridor between low houses, dreary and monotonous, with rooms like cells, where a pall of smoke descends and rests. Four or five 'clearings,' where the buildings are less crowded, sketch vague limits between these funereal towns. From Wolverhampton to Birmingham more than a million beings of human form stifle in the poisoned air of a dozen cities and hideous suburbs for an extent of over a hundred square miles, with collieries and lofty furnaces, forges and workshops, factories, narrow yards, huge storehouses, and swarming streets. In the 17th century, the gentry of the neighborhood hunted and tracked game in this very region.—The train rushes on. The smoke clears away. Once more the turquoise sky smiles between the trees and above the meadows. We shoot past a station with platforms prolonged into flower beds. On the right, covered with ivy, are massive walls: Warwick. From beauty to horror, and from darkness to light. Between the Welsh hills and the castle of the 'king maker,' lordly still in its ruins, the Black Country makes an impressive contrast. On this corner of the country, man and the industrial age have branded their mark as with red hot iron."

Canal, a lock canal, voted by Parliament in 1885, begun in 1887, and opened on January 1, 1894.[1]

Manchester, the city of cotton, is in close relation with Liverpool, a great historic port which receives the raw material and exports the manufactured cotton. The development of Manchester dates from the application of steam to spinning: in 1696 it was simply a small, badly built city of 6,000 inhabitants; from 1786 to 1801 the population grew from 30,000 to 94,000, and by the census of 1911 it had reached 714,000; if we include Salford, we may say that 1,000,000 inhabitants are established in Manchester and its suburbs. Liverpool joins an ancient but renewed maritime situation to a continental situation entirely new. Formerly the slave trade made fortunes for the shipowners of Liverpool, who developed docks for 24 miles (40 kilometers). To-day the docks and slips of Liverpool and Birkenhead cover 544 acres and have 34 miles of quays; the entire estuary of the Mersey is like a suburb of Liverpool.

Liverpool, which had 4,000 inhabitants in 1696, in 1914 had 763,000, and around it are many cities of over 100,000 inhabitants: Birkenhead (135,000), Oldham (150,000), Bolton (184,000), Blackburn (134,000), Preston (119,000). In the face of these masses of human beings carried along by the fierce activity of business, why has the little city of Lancaster, with its 41,000 inhabitants, remained in name the political capital?

3. *The coal fields of Wales.*—Cardiff, thanks to coal and to the industrial activity developed by coal, is in tonnage the third of the British ports (ahead of Newcastle, which is classed as fourth). In 1801 there were fewer than 2,000 inhabitants; in 1911 there were 182,260 inhabitants. Swansea, a great industrial center for tin, has 114,660 inhabitants.

4. *The Scotch coal fields.*—The port of Glasgow did not exist two hundred years ago; the great works were begun after the Act of Union. The city grew rich through the importation of tobacco from Virginia and Maryland and then finally through coal and because of all the industrial activity of the basin of the Clyde: iron foundries at Airdrie, weaving at

[1] See Lozé, I, pp. 520 ff.; and Yule Oldham, *Geog. Jour.*, June 1894, pp. 485–492, with one plan.

Paisley, etc. To-day Glasgow has 1,010,000 inhabitants, while Edinburgh has only 320,000; it is the leading city of a region where the density of population reaches nearly 231 inhabitants per square mile (600 per square kilometer).

London.—It is impossible to study the geography of coal in Great Britain without speaking of London, an example of the historic city which has become an industrial city. London has not given up its pretensions to being the commercial metropolis of the world. To become a great port it has had to become a great industrial city. Industries have not come of themselves but men have brought them. By the tenacity of the English will, by the laborious effort of her merchants, London has maintained her position and has grown prodigiously. She has become the most colossal type of monstrous urban agglomerations, with no close rival except New York City. The county of London counted in 1911, 4,521,685 inhabitants. The district of the councils of jurisdiction contains more than 7,000,000 inhabitants,[1] that is, more than Paris, Vienna, and Berlin together, and much more than the total population of two countries such as Norway and Denmark, and almost double the total population of Switzerland (3,877,000 by the census of 1910). All this mass of men grouped at a single point of space! London in 1801 had fewer than 1,000,000 inhabitants (958,000).[2]

London had no coal; she had to import it. She profited by the old relations between Newcastle and her port on the Thames: in 1750 as much as 863,633 tons were already being transported annually from the northern coal field to London, and forty-five years later, in 1795, this tonnage had nearly doubled (1,242,399 tons).[3] To-day the northern coal field is still the great source of coal for the huge industrial city. Because of a perfect organization of the work and of special technical devices for loading and unloading, steam vessels take only three days and six hours to load with coal, go to London, and return to Newcastle.[4]

[1] Census of April 2, 1911: 7,323,000.

[2] See, for example, Price, *The Population of London, 1801–81*, and Kemmann, *Der Verkehr London*, Springer, Berlin, 1892.

[3] See the figures cited under the title: "The Circulation of Coal," pp. 397 ff.

[4] See Lozé, *op. cit.*, pp. 108 ff.

In a purely geological study of coal a place would be given to the new coal field in the southeast of Great Britain,[1] but from the human point of view that is a subject only for future study.

It would now be proper to take up again the general considerations set forth in the preceding pages and see what their application may be to Great Britain.

Through the advent of coal all the historic activity of England has been displaced. With the exception of London all the cities that count are cities within the coal zone.[2] A map of the density of population shows that the places with increases are the suburbs of London and all the coal counties[3] (see Fig. 150).

Many general conclusions will doubtless be drawn from a thorough study such as we have been able to indicate here only in outline.

As phenomena which form a covering on the surface of the earth it will be important to note the accumulation of great public works in the regions of industrial cities: the construction of canals, such as those mentioned in connection with Manchester; the multiplication of all the ways of transportation by land and water, especially railroads; and finally, such exceptional works as the three-mile tunnel under the Severn connecting Bristol with the opposite bank of the river.

From the point of view of economic activity we find in the England of coal and industry some very representative specimens of the tendency to monopolization.

Leeds, having become a wool center, tends to draw the wool of the entire world. Liverpool and Manchester draw cotton from everywhere—from India, from Egypt, from the Mississippi Valley.[4] Swansea is becoming a great world center for

[1]See the article by Lozé in *La Géographie*, September 15, 1907, pp. 145–162.

[2]Mark Jefferson, "The Distribution of British Cities and the Empire," *Geog. Rev.*, IV, 1917, pp. 387–394.

[3]From the political point of view, the same change in place of activity is shown: the radicalism and imperialism of Chamberlain have had as their center and place of electoral support, Birmingham (see Victor Bérard, and below, chap. VIII, §4). See, in the book by Paul Mantoux, *La Révolution industrielle en Angleterre au XVIII^e siècle*, pp. 360–365, the four maps which represent the distribution of the population at the four following dates: 1700, 1750, 1801, 1901.

[4]Note, however, that these monopolies, instead of increasing, tend to diminish in influence. One-third of the cotton cloth exported by the United Kingdom is sent out through ports other than those of Manchester and Liverpool.

work in tin. (We might likewise note how in France, for example, the Creusot works, after having at first used the iron ores nearby, have become a great center of attraction for the iron of Spain, Algeria, etc. Essen, in Germany, illustrates the same law.)

FIG. 150. THE DISTRIBUTION OF POPULATION IN THE UNITED KINGDOM

On a map of the density of population—with the historical and traditional exception of London—can be read, so to speak, the distribution of the principal coal fields. Compare with Fig. 149, p. 397.

2. COAL IN GERMANY

What makes the economic power of Germany is the geographical coincidence between its historical development and its industrial development through the coal. While the England of coal was separated from the historic England, with, as a result, the veritable economic and even political revolution which we have pointed out, the coal regions of Germany have revealed themselves as if superimposed upon the older historic regions. The exploitation of coal and industrial activity began later in Germany than in England, but Germany has been remarkably aided by this fortunate coincidence, of which we shall briefly indicate the geographic phases.

With the exception of the rich zones of clays and loess which fringe the mountains, Germany a hundred years ago was a country in large part in its natural state with an agricultural production that was worse than mediocre.[1]

The old mountainous country of the Hercynian zone is bordered on the north by the great Germanic plain, *Norddeutsches Flachland*, a sort of narrowed prolongation of that vast flat Europe of the east. This plain is covered with glacial deposits, erratic blocks, lakes and marshes of every size; the ground is irregular, chaotic, covered with moors and heaths, forests of pines, or damp bogs. In short, the region is little suited to human establishment and rebellious to intensive exploitation.

This plain toward the south comes in contact with the mountain, forming a whole series of festoons that project forward mainly in three large gulfs: the double gulf of Cologne and Westphalia, the gulf of Saxony with Halle and Leipzig, and the gulf of Silesia with Breslau. It is also by way of these gulfs that the Rhine, the Saal, the Mulde, the Elbe, and finally the Oder escape from the mountains to join the northern seas.

The transition from the mountain to the plain is very gradual, and along this line of contact from one end to the other, from west to east, a series of cities with a historic past have naturally located themselves, so that it becomes a very important border of human beings and large cities: Cologne, Münster, Osnabrück, Minden, Hanover, Göttingen, Magdeburg, Halle,

[1]See Werner Sombart, *Die deutsche Volkswirtschaft im Neunzehnten Jahrhundert*, Georg Bondi, Berlin, 1903.

Leipzig, Dresden, Breslau. These three gulfs represent the essential regions of historic settlement from the point of view of cities as well as geology and orography.

Now this great zone of contact, and especially the three gulfs, are, in the part formed by the plain which is rich in land suitable for cultivation (clay and loess), very well provided with natural means of communication, and in the mountainous part very rich in pure water, wood, and deposits of ore.

As a result of a geographical phenomenon analogous to that which explains the deposit of coal in Great Britain all about the old highlands, coal has been concentrated around the old highlands in middle Germany. But while this border in England, before the nineteenth century, was but little inhabited or even almost deserted, three of the most important coal beds of Germany discovered on the face of the mountains have coincided, not unnaturally, with the three great gulfs of historic activity.

The Saar coal fields had a very great part to play in German industry but these have now been internationalized in favor of France as a contribution toward the indemnity that Germany has to pay the Allied Powers. Sixteen per cent of Germany's coal production was in the Saar region. At the end of fifteen years a plebiscite is to determine final ownership. We wish particularly to call attention to the phenomena of the three groups of coal beds of Westphalia, Saxony, and Silesia.[1]

A. Owing to the clear water, the abundance of fuel furnished by the forests, and the presence of iron ore, the last spurs of the Rothaar and of the Sauerland are among the oldest industrial centers of central Europe. In the eleventh century Cologne was not only a political and intellectual center, but also an industrial center with its cloth factories and its market for precious metals.

B. In the same way, around the "gulf" of Saxony are the Hartz Mountains, whose silver, lead, and iron mines are very old and were valuable resources for the first emperors of the House of Saxony. Near by extends the saliferous region, the

[1]It is, moreover, the Rhine-Westphalia basin that is the greatest producer. Hugo Böttger, a member of the Reichstag, wrote in 1909 that 56 per cent of the total production of Germany came from there, while the coal region of Upper and Lower Silesia furnished 27 per cent and that of Saarbrück only 10 per cent ("L'Industrie et le commerce des charbons en Allemagne," *Rev. écon. internat.* April 15–20, 1909, p. 104).

influence of which is seen in the names of Halle and Saale. To the south, finally, is the Erzgebirge, whose silver mines were already celebrated in the twelfth century, and which has been one of the cradles of the metallurgic industry in Europe.

C. Even the gulf of Silesia, along the border of the Sudetes, had in the Middle Ages only small industrial cities where flax was spun and woven. As history developed, these old centers found themselves isolated; on the north they were bordered by that great, infertile, inhospitable plain which unfortunately separated them from the Hanseatic ports and placed a barrier between industry and commerce difficult to overcome.

Part of the Silesian coal fields will undoubtedly go to Poland as a result of the plebiscite which, by the terms of the Peace Treaty of 1919, is to determine final ownership as between Germany and Poland.

In the eighteenth century Cologne had fallen from its past grandeur, Dresden was only a museum, and Breslau had long been on the road to complete decline.

At this particular point in history there entered a group of human facts which were to prepare and favor the later work of coal. In the midst of this great damp and marshy plain of northern Germany and stretching from west to east there is a topographic depression, a transverse groove,[1] which corresponds to a stage of withdrawal of the great Scandinavian glacial cap.

It was the Great Elector and Frederick II who began the immense and fruitful work, which is being finished in our own day and which consists of building an unbroken system of waterways from east to west, a continuous and easy commercial route from the Vistula to the Oder and the Elbe (later even to the Ems and the Rhine).[2]

Berlin was created almost entirely in the seventeenth and the eighteenth centuries,[3] at a point where the glacial ridges of

[1] In reality a double groove.

[2] See in the March, 1910, number of *Petermanns Mitt.* the article by Professor Gravelius, "Zur Frage der Schiffahrtsabgaben auf deutschen Flüsse," LVI, 1910, pp. 123–126, and especially the map which accompanies it: "Binnenschiffahrtsstrassen im Deutschen Reich," scale of 1:3,700,000, Table 21.

[3] At the time of the Thirty Years' War, Berlin had only 12,000 inhabitants; again, the plague made the population go down to 9,000 and even to 5,000, under George William. On the contrary, at the death of the Grand Elector, early in the 17th century, Berlin had already 20,000 inhabitants; at the death of Frederick William the First it counted 100,000 inhabitants and 4,200 houses, and at the death of Frederick-William the Second, successor of Frederick the Great, 165,000 inhabitants and 6,900 houses.

the north and south, both with low relief, draw near to each other and form a sort of defile, in which flows the Spree. Berlin is a great river center established midway on the water route which runs from the Russian frontier to the lower Elbe and hence to Hamburg and may be considered a sort of back-port for Hamburg. It is a political capital which, by installing itself in the midst of the neglected hinterland, forced this region to become a great center of intercourse and, by the development of communication, strengthened the hitherto feeble bond between the great seaports of the North Sea and of the Baltic and the historic centers of the three southern gulfs already mentioned. Everything is now ready, it would seem, for the exploitation of coal to produce its maximum effect.

All modern Germany, which is an industrial and commercial Germany, is explained by this superposition of the industrial activity due to coal upon the old historic activity of the cities. But all that has been possible, or at least has reached its highest point, only through the creation of that central water artery which joins two metropolises, the one essentially industrial (Berlin, 2,121,000 inhabitants, and with its suburbs 3,000,000 or even 3,500,000 in 1912), and the other predominantly commercial (Hamburg, 936,000 inhabitants).

ADVANCE IN POPULATION IN THOUSANDS OF INHABITANTS

	1801	1850	1871	1895	1900	1905	1910
Berlin[1]	172	415	826	1,677	2,500	2,793	3,430
Hamburg	100	161	240	625	706	803	936

In the chapter on historic geography (chap. VIII, § 4), it will be in place to point out briefly the general influence of all these economic facts upon the political history of contemporary Germany.

[1]Figures for 1900, 1905, 1910 include the suburbs. The progress of the single city of Berlin, year by year (without the suburbs), in thousands of inhabitants:

1899	1,846	1905	2,043
1900	1,888	1906	2,091
1901	1,893	1907	2,104
1902	1,911	1908	2,111
1903	1,946	1909	2,111
1904	1,988	1910	2,121

On January 2, 1910, Berlin had 2,121,134 inhabitants. All the figures in the table, up to 1908, are from the *Statistisches Jahrbuch der Stadt Berlin*, 31, issued by H. Silbergleit, Berlin, 1909. The last three figures are supplied through the courtesy of C. Wendt, librarian of the Royal Bureau of Statistics of Prussia, at Berlin.

A map of the density of the population in Germany shows at the same time to what extent the economic life of to-day has been concentrated and developed within the regions

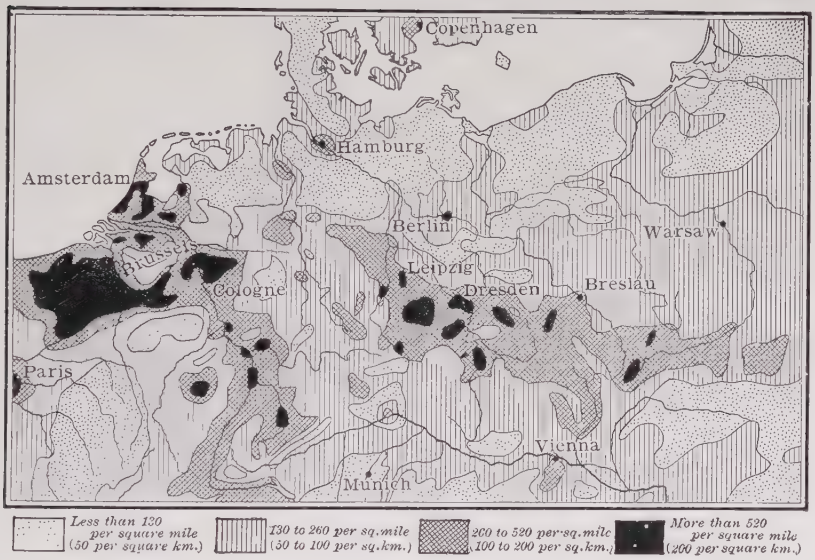

FIG. 151. POPULATION ZONES OF CONTEMPORARY GERMANY

Besides the very populous region of the middle Rhine, the three "gulfs" are seen: that of the east (Silesia) joins that of the center (Saxony); that of the west joins the region of dense population in the coal and industrial fields of France and Belgium.

which we have called the three historic gulfs, and of what importance for all contemporary Germany is the geographical significance of the development of Berlin and Hamburg (see Fig. 151).

A map of all Europe shows the general predominance of population along that great fringe which begins almost with the coal fields of the Donetz and runs to the coal fields of Wales (see Fig. 152), a long line of factories, an almost unbroken strip of crowded humanity.

E. Coal in Other Countries. The Circulation of Coal

The same facts that we have observed as marking the coal deposits of Great Britain and of Germany may be verified in all the fields where coal is exploited.

Such regional studies should be pursued by seeking both the great general facts and the phenomena more peculiar to a given region. In connection with the Franco-Belgian region and the coal fields of the north and of Pas-de-Calais,[1] it would be worth while to analyze the relation of the coal which is extracted at these points with the industrial and

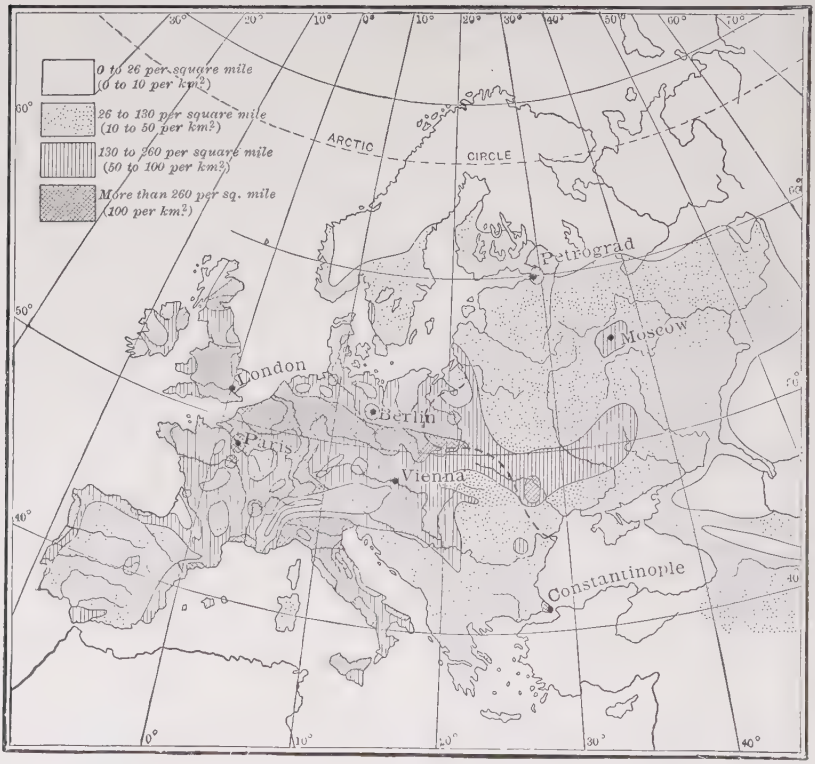

FIG. 152. POPULATION ZONES OF CONTEMPORARY EUROPE

The broken line is merely for reference; it is the line of the former Russian frontier. It is seen here to what an extent the facts of population density are independent of political boundaries even toward the east.

commercial center of Paris: the development of the traffic on all the canals of the north, of the navigation of the Oise, and

[1] In France, in 1908, the collieries of Nord and of Pas-de-Calais alone produced 26¾ million American tons—that is to say 64.5 per cent of the total production of the country. And this is not an exceptional fact but an almost constant proportion (see, for example, the diagram of Fig. 153 for the year 1916).

even indirectly of the lower Seine. The great importance of Paris as a river port should be emphasized.

Between the network of the canals of the north, with particularly a local trade and a regional importance, and the line of the Seine, with an ancient historic and economic life which has been recently improved, but where the improvements have allowed its life to continue rather than to be transformed, is the furrow and natural road formed by the Oise, which has acquired all its importance in the nineteenth century. A true purveyor of coal for the great industrial center of Paris, the Oise had a decisive influence in the happy outcome of an important part of French economic history (see Fig. 154). But for it the great economic capital would have burned but a ridiculously small proportion of the national coal, and the port of Paris would have been flooded as formerly, but with more disastrous consequences, by coal from England.[1]

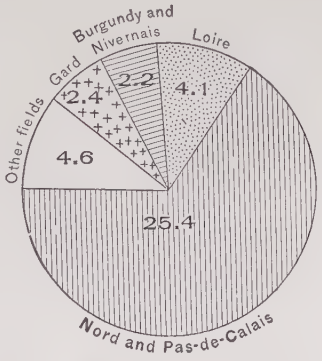

FIG. 153. THE PREDOMINANCE OF THE PRODUCTION OF COAL IN THE DEPARTMENTS OF PAS-DE-CALAIS AND NORD, FRANCE

The figures indicate the production in millions of tons and are for the year 1916.

As a type of coal and industrial region far from the sea one might choose the region of Saint Étienne, or the region of Montceau-Blanzy, with the Creusot iron works, which corresponds with a narrow depression between the Morvan and the Charolais groups of ancient rocks. In the latter case it would become evident that the coal is to-day only an accessory industry, which is unimportant in comparison with metallurgy; it would also be clear that the Central Canal, constructed too soon—that is, before the industrial development of Creusot—passes too far from the present active center to serve it profitably.[2]

[1] E. Gruner, *Les Voies navigables du Nord de la France, vers Paris, leur état actuel, mesures à prendre en vue d'en augmenter l'effet utile*, Central Committee of the Collieries of France, February, 1897, Paris.

[2] For the study of the French coal basins, there are three excellent publications by the Central Committee of the Collieries of France, and especially its *Atlas*.

The transportation of coal, its general "circulation," brings in much more complicated facts, and causes much more active competition than one might imagine.

We have already noted the intimate connection between

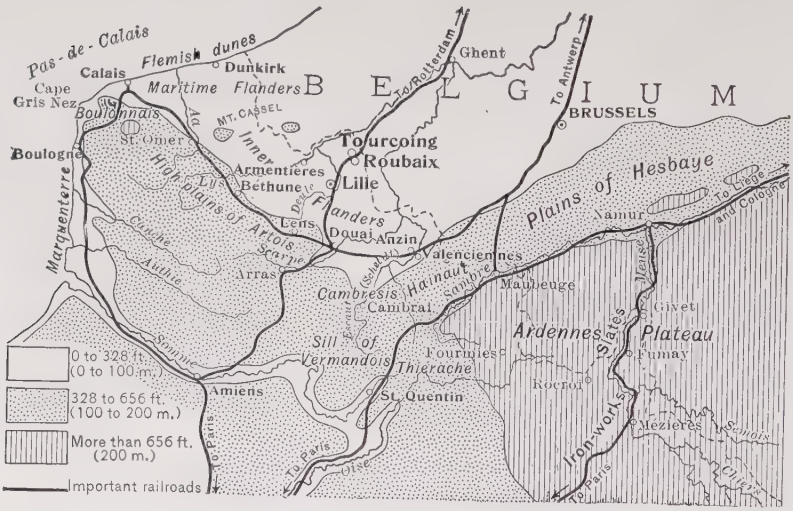

FIG. 154. THE COAL AND INDUSTRIAL REGION OF THE FRANCO-BELGIAN FIELD AND THE HEAD OF THE OISE VALLEY LEADING TOWARD PARIS

the coal of Newcastle and the prodigious activity of the London industrial center. The "maritime circulation" of coal is vast, but it is not the only circulation. More and more to-day the railroads, almost as much as the sea, assure to the English metropolis its supply of coal.

COAL CARRIED TO LONDON FROM 1905 TO 1909[1]

Method of Transportation	1905 Tons	1906 Tons	1907 Tons	1908 Tons	1909 Tons
By railroad	7,993,969	8,348,423	9,198,797	9,030,423	8,609,727
By canal	20,592	28,008	27,549	25,679	31,123
By sea	9,363,194	9,229,722	9,041,914	8,846,166	9,809,162
Total	17,377,755	17,606,153	18,268,260	17,902,268	18,450,012

In human geography it would not be necessary to follow coal under the soil, for example under the Campine and Holland —a task for geologists—but wherever coal is transported

[1]According to the *Coal Tables*, 1908–1909, London, 1910, p. 54.

over land or sea. It would be necessary to follow English coal to Marseilles and to Genoa (where in one of these places, Marseilles, it meets with French coal, circulating with difficulty over the interior railroad system of France, and in the other with German coal, which has come through the Gotthard tunnel) and see it, owing to the ease and cheapness of transportation by sea, determining industrial centers in both places. These centers appear theoretically far from coal, but they are in reality close to it.[1] It would be necessary to follow Australian coal in its dispersion from New South Wales across the entire Pacific and then explain the expansion and present decay of the traffic. It would be necessary to note how the coal of India has made possible the establishment and development of native industry—the cotton industry of Bombay, which competes with Manchester; the jute industry of Calcutta, which competes with Dublin.[2] It would finally be necessary to grasp the stimulating influence of coal wherever it is simply consigned to storage for recoaling purposes: the island of Perim, at the narrow outlet of the Red Sea, living by means of the coal of Newcastle, and even Algiers, which has acquired a large part of its present importance by reason of being a coal port, etc.

It is difficult to attempt to sketch briefly the general picture of the complex circulation of coal. Evidently coal follows customary routes that have become, as it were, fixed. Of the 13 or 14 million tons of coal which the United States has exported annually within recent years, 11 million tons, or about four-fifths of the total, have been sent into the Dominion of Canada.[3] Likewise upon the sea there are regular lines devoted to the transportation of coal, as, for example,

[1]From 1886 to 1900 more than half the English coal exported has been for Mediterranean ports; see D. A. Thomas, "The Growth and Direction of Our Foreign Trade in Coal during the Last Half Century," *J. R. Stat. Soc.*, LXVI, Part III, 1903, pp. 439–534, 1 diagram and 1 map. Let us add that English coal goes even as far as Genoa for a cheaper rate and in greater quantity than the German coal.

[2]In 1908 English India had produced almost 13 million tons (only 1 million in 1878); see Pierre Clerget, *La Géographie*, January 15, 1910, p. 57.

[3]The exact figures for the years of the Census ending June 30, 1909, are:

Coal Exported by the United States in Millions of Tons:

	General Total	To Canada
1906–1907	13.3	9.9
1907–1908	14.7	11.0
1908–1909	13.9	10.9

from Cardiff and Newcastle to Rouen and Havre.[1] But these are really exceptions. A large part of the coal transported by sea is taken as ballast at reduced rates by tramp steamers.[2]

In view of the impossibility of obtaining cargoes for each voyage, it is often preferable to carry a substitute for ballast rather than a mere dead weight of sand or water. The chief of these substitutes is coal, of which by far the largest part transported over the ocean is not taken as a paying load, but as lost weight in the sense that it does not pay the real cost of the voyage; but its very small freightage is always worth a little more than the pure loss in the transportation of ballast, which must itself be bought and loaded and unloaded at the expense of considerable labor.

The influence of this factor of ballast causes the exportation of coal to have no significance in comparison with coal resources or even coal extraction. Thus Great Britain, which exports annually more than 60 million tons of coal, although she mines less, transports by sea several times as much coal to foreign countries as the United States. This British export coal is eagerly sought after by thousands of tramp vessels, both sailing and steam, which unload annually in English ports the enormous quantity of wheat, maize, cotton, wood, rice, and other commodities or raw materials with which this manufacturing nation feeds itself and its mills.

The exportation of finished products requires so little room that the vessels of the regular lines can take care of it almost entirely. Many tramp vessels leave port loaded with ballast and the others carry the greater part of the 60 million tons of exported coal at a price so low that English coal could sometimes be carried to Peru or even to San Francisco at $2.50 (ten shillings) per ton. English coal is regularly exported to Chile and South Africa; the Argentine Republic and Brazil each receive at the present time about a million tons per year, while the United States, the coal of which costs the same price and is of better quality, sends annually to these countries only a few cargoes of a special kind of coal.

Thus Japan and Australia, as coal-producing countries, can be compared only with American states of the fourth class, but conditions of ocean transportation make them relatively important exporters distributing coal to vast regions. For a long time San Francisco regularly imported coal from Australia, Wales, and the north Atlantic ports of the United States. To-day, Japanese coal

[1]The chief customer of the United Kingdom for coal is France.

Coal Exported by the United Kingdom in Millions of Tons:

	General Total	To France
1907	72.7	12.0
1908	71.7	11.6
1909	72.3	11.6

According to the *Coal Tables*, 1908–1909, London, 1910.

[2]Consult W. Stanley Jevons, "Foreign Trade in Coal," *Publications of the Department of Economics in University College of South Wales*, King and Son, London.

goes to Alaska, whose coast is not so far from our mines as the old Japanese coal markets of Honolulu and San Francisco.[1]

The two greatest coal-exporting countries in the world are the two whose coal regions we have examined in some detail—the United Kingdom with an annual exportation of about 60 million tons and Germany with nearly 30 millions. What has been said is sufficient to give a glimpse of all the different questions of a geographical character which are raised by coal—a great revolutionary force which has made and unmade cities and which has often shown itself the mistress of the economic and political destinies of states and provinces.

F. Statistics of Production

After all the regional and local analyses, let us examine, with the help of statistics, the economic total—that is, after the geographical study, the statistical study. This will show us better than any other the full significance of the phenomena examined. It will further show to what degree year by year the United States is winning industrial predominance.

Production of Coal and Lignite in the Chief Producing Countries in Millions of Tons

	1860	1870	1880	1885	1895	1901	1904	1908	1909	1912
United States	14.6	33.0	71.4	111.1	193.1	293.2	351.8	415.8	460.8	534.4
Great Britain	92.0	123.4	164.2	178.6	212.2	245.3	260.3	292.9	295.3	321.9
Germany	18.2	37.5	65.0	81.0	114.6	168.6	186.7	237.2	239.6	231.9
Austria-Hungary	3.8	.....	17.6	22.6	34.7	.....	43.0	44.6	52.5	56.9
France	9.4	14.9	21.5	21.5	30.9	35.6	37.7	41.2	41.7	45.1
Belgium	10.5	14.9	18.7	19.3	22.6	24.4	25.3	25.9	25.9	25.3
Russia	0.3	0.8	3.6	4.7	.....	18.2	21.6	23.9	28.6	31.7

Total World Production of Coal and Lignite in Millions of Tons[2]

1890	518	1905	930
1895	561	1906	984
1900	767	1907	1,113
1901	786	1908	1,168
1902	802	1909	1,310
1903	883	1912	1,377
1904	886	1913	1,478

For the first time in 1907, and again in 1908, the production

[1] J. Russell Smith, "Les Transports océaniques," *Rev. écon. internat.*, March 15–20, 1911, pp. 454 and 455; also J. Russell Smith, *The Ocean Carrier; a History and Analysis of the Service and Discussion of the Rates of Ocean Transportation*, G. P. Putnam's Sons, New York, 1908.

[2] Yearbook of the U. S. Department of Agriculture, 1915.

of coal and lignite exceeded a billion tons, and this production will doubtless continue in the years to come.

Let us compare this gigantic amount with the total of some other products of extractive industry for the two years (1908 and 1909)[1]:

	1908	1909
	In Millions of Tons	
Sea salt and rock salt	15.8	16.3
Petroleum	40.0	41.0
Iron ore	123.0	148.6
Coal and lignite	1,168.0	1,310.0

Statistics for the world at large certainly confirm the very great importance we have given to this last type of extractive industry.

[1]According to the tables of "Statistiques internationales" of the volumes *Statistiques de l'industrie minérale et des appareils à vapeur en France et en Algérie pour l'année 1908, ... pour l'année 1909* (official publications of the Ministry of Public Works).

CHAPTER VI

SPECIAL STUDIES OF SMALL NATURAL UNITS

FIRST EXAMPLE: TYPES OF "ISLANDS" OF THE DESERT: THE OASES OF THE SUF AND OF THE MZAB

1. *The islands. The islands of the stony desert and of the sandy desert.*
2. *The dunes of the Suf. The gardens, the houses, and the cities. The Soafas.*
3. *The Shebka of the Mzab. The wells and the gardens. The houses and the cities. The Mozabites.*
4. *Conclusions: The Suf and the Mzab.*

1. THE ISLANDS. THE ISLANDS OF THE STONY DESERT AND OF THE SANDY DESERT

After having studied the series or groups of human facts—facts of the unproductive occupation of the soil, facts of plant and animal conquest, facts of destructive exploitation—let us approach these facts as a whole in all their natural complexity.[1] In the study of natural unities human geography should first try its hand on the "islands." As definite specimens we shall choose representative types of "islands" of the desert and then, in the following chapter, "island" groups of the high mountain.

Much has been said of the Soafas and their gardens, of the Mozabites and their wells; and the language, the race, the religion, and the history of both these peoples have been often spoken of. Much has even been written about the

[1]Needless, to say, this classification, which simplifies analysis and investigation, is not to be imposed as a sacred formula on all studies in human geography. On the contrary, so far as possible, geographic study should represent life just as it presents itself, with its own particular features in each natural environment; here the dominant fact will be fisheries; there, the herd; again, fields or houses; and in the general study of unities or of regions of the earth it is the typical and significant fact one must try to put in the foreground. Certainly in an irrigated region everything depends upon a well-watered garden; it is therefore with the garden that this study must begin. We have tried to keep faithfully to the true order of importance in the double monograph which follows.

Mzab,[1] and, while the literature concerning the Suf is not so abundant,—which is natural—it is at least sufficient.[2]

There is a great depression of the Wad Rir' which runs from the Shot Melrir to Tugurt and bending toward the southwest continues as far as Wargla. In places the ground-water near the surface shows itself in *shots* while the deeper water issues from artesian wells. On both sides of this region extend two masses of very different aspect and nature, but both infertile and inhospitable. On the one side, toward the east, are the great dunes which are the northern prolongation and the limit of the eastern Erg; on the other, toward the west, is the calcareous, rocky Shebka, with surfaces of *hamada;* on the one side the desert of sand, on the other the desert of stone.

In each of these two desert regions different peoples, equally independent and original, have succeeded in establishing themselves and subsisting. They have created and maintained oases: in the midst of the dunes, the oases of the Suf; in the midst of the Shebka, the oases of the Mzab. In each region are nearly 200,000 date palms which feed more than 20,000 inhabitants—large numbers for plantations and populations

[1]The excellent thesis by Masqueray, *Formation des cités chez les populations sédentaires de l'Algérie* (Paris, 1886), deserves special mention. This volume begins with a critical bibliography—a special bibliography of the Wad Mzab, pp. xliii–lxviii. Particularly to be noted among the works and articles given by Masqueray are: the articles by Duveyrier, "Tour du monde," 1861, *Petermanns Mitt.*, 1859 and 1860, to which he certainly should have added the first one, which appeared in the *Bull. de la Société de géographie de Paris*, 4th series, XVIII, 1859, "Coup d'œil sur le pays des Beni-Mezab et sur celui des Chaanba occidentaux;" the book by Ville (1872), and the brochure by Coyne, *Le Mzab* (1879). Among more recent works should be noted the following: E. Zeys, *Législation mozabite, son origine, ses sources, son présent, son avenir*, Algiers, 1886 (a full inter-page bibliography); Dr. Ch. Amat, *Le Mzab et les Mzabites*, Paris, 1888; A. König, *Reisen und Forschungen in Algerien*, s. l. n. d. (imp. Dornbluth, at Bernburg, 1896); Dr. J. Huguet, "Dans le Sud-Algérien," *Bull. Soc. géog.*, 7th series, XX, 1899; "Les Juifs du Mzab," *Bull. et mém. Soc. d'anthropologie de Paris*, 5th series, III, 1902, pp. 559–573; "Les Soffs," *Rev. école d'anthropologie de Paris*, XIII, 1903, pp. 94–99, etc.; a good study by Lieutenant Charlet, "Les Palmiers du Mzab," *Bull. Soc. de géographie d'Alger*, X, 1905, pp. 11–87; and various articles which we shall have occasion to quote: Captain de l'Eprevier, M. Idoux, etc. See finally the exact work of Féliu, *Étude sur la législation des eaux dans la chebka du Mzab*.

[2]Again, some rather superficial remarks are to be found in certain works such as Largeau's *Le Sahara algérien, les déserts de l'Erg* (2d edition, Hachette, Paris, 1881), pp. 325–338, etc. But one may always consult with profit, for the Suf as well as for the Mzab, the general and fundamental works by G. Rolland and H. Schirmer, and one will find very useful information in the "Revues bibliographiques des travaux sur la géographie de l'Afrique septentrionale," which Augustin Bernard has published every year since 1898, *Bull. de la Soc. de géographie d'Alger*, as well as in A. Bernard and N. Lacroix, *Historique de la pénétration saharienne*, Algiers-Mustapha, 1900. See finally the paper by R. Rousseau on the countries of the Soafas in *La Géographie*, May 15, 1907, pp. 393–395. From the point of view of "La Position géographique à El-Oued (Suf)," we adopt the conclusions of the article by Paul Pelet, which appeared under this title in *La Géographie*, XII, 1905, pp. 29–34 and pl. 1.

in the open desert. These oases, thus established in the Sahara by men who had at their disposition neither streams nor springs, are veritable masterpieces of the art of cultivation and at first view, genuine paradoxes. In both places the result is obtained by extraordinarily persistent toil. In the Suf a continual struggle must be maintained against the sand-laden winds; in the Mzab, an unceasing toil to obtain the indispensable water.

In short, these two groups of oases, so unlike each other, seem to show two extreme types of careful and productive cultivation under exceptionally unfavorable conditions.

2. THE DUNES OF THE SUF. THE GARDENS, THE HOUSES, AND THE CITIES. THE SOAFAS

The Setting: The Dunes

The dunes which form the Eastern Erg stretch out to the *shots;* but the Erg, which is spread out wide from west to east between 30° and 32° north latitude, grows narrower toward the north. The most northern part is a small area of sand shut in by a large semicircle of depressions; to the west, the Wad Rir' with its almost lagoon-like series of lowlands, *shebkas,* or *shots,* bordered by artesian wells; to the north, the great depression of the northern *shots;* and to the east, the Shot el Jerid (see Fig. 155).

It is in the middle of this northern part of the Erg, that is, in the midst of the dunes, that we find the oases of the Suf. Lost amid the sands and separated by a journey of several days[1] from all other groups of oases, they form a little world apart. One must know their setting in order to understand the exceptional character of these oases. One must have traveled through the dunes in order to appreciate at their full value the curious gardens of the Suf. Traveling to El Wed[2]

[1]To go from the oases of the Suf to Tugurt requires a hard two days' journey; to go to Djerid, three days; and to Ziban, five days.

[2]From El Wed to Tugurt there are 57 miles (92 kilometers) of telegraph wire; it must be about 60 miles there on foot. It takes fifteen hours by horse; on foot, an Arab of the region, walking straight ahead, made the trip in fourteen hours, but that was an exceptional case. On the map (scale 1:1,400,000) there is a mistake: El Wed is put too near Tugurt. Paul Pelet in his *Atlas des colonies françaises* has fortunately corrected this mistake; but, on the other hand, he has brought *El Wed* a little too near the 5th long. E. (Paris); see map No. 7, *Sahara algérien et tunisien,* and map No. 5, *Algérie* III, *Prov. de Constantine.* See "La Position géographique d'El-Oued," an article (mentioned above) by the same Paul Pelet in *La Géographie,* July 15, 1905, pp. 29–34, with a map, which adopts finally as coördinated with El Wed: Long. E. Paris, 4° 57′ 20″: Lat. N. 33° 19′ 50″.

from Tugurt, one crosses successive strips of dunes, nearly parallel with each other. The strips of active dunes, piled high with almost bare sand, stand out like bright lines (Fig. 156), while the strips of dead or extinct dunes have more vegetation and from a distance appear as darker etches.

Thus the zone of the dunes proceeds; to a zone upon which the wind is now acting, working and modeling it and giving it irregularities of relief which are constantly changing, there succeeds another zone, a little lower and much less irregular, which the wind is sprinkling more uniformly with sand. This is a zone of aggradation. The general direction of these successive and alternate zones is north-northwest to south-southeast; toward the south the direction becomes a little more north-south. Moreover, these zones, instead of being absolutely rectilinear, bend slightly, with a marked tendency to form arcs of a circle with very gentle curvature.

Beyond the zones of the highest active dunes, such as the region of Ourmes (Bu-Ourmes), we find the flat surfaces or the

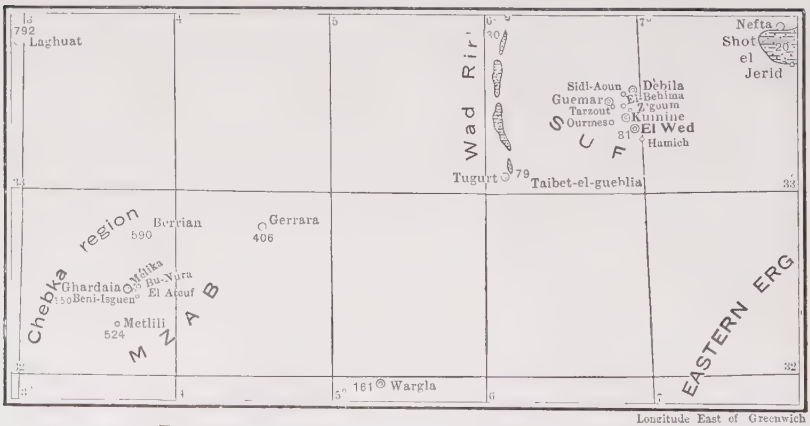

FIG. 155. OASES OF THE SUF AND OF THE MZAB

In fixing the orientation of this map the conclusions drawn from the investigations of Paul Pelet have been adopted for El Wed, which is 33° 19′ 50″ N. Lat. and 4° 57′ 20″ E. Long. from Paris. See note p. 417.

widest *couloirs* such as the relatively depressed strip which is now occupied by the oases of the Suf. This slight depression of the region of the oases gives it the appearance of a very wide valley of a Quaternary *wadi* (ravine) and explains the legend,

still repeated by the oldest inhabitants, that formerly a wide river flowed through the country, the Wad Suf, which has

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FIG. 156. VIEW OF THE SANDS AT THE SUF OASIS. TYPICAL ASPECT OF A ZONE OF ACTIVE DUNES

disappeared and now flows underground.[1] That the Christians, the predecessors of the Soafas, saw the Wad Suf flowing on the surface is purely legendary, but it is none the less true that the oases are situated, if not above a subterranean stream, at least above a *water surface* or a series of subterranean pockets in which water is stored up in rather large quantities. "The Wad Suf," says Georges Rolland, "must, in my opinion, correspond to a more or less distinct waterway—or at least to a zone of successive depressions—which must begin far above the present oases and run from southeast to northwest toward the Shot Melrir but the course of which is to-day almost entirely masked by the great sand dunes of the eastern Erg."[2] Moreover, as all the explorers and scholars who have studied the region insist, the great dunes throughout the Sahara play the part of veritable water reservoirs.[3]

[1] See, H. Jus, article quoted, and G. Rolland, *Hydrologie du Sahara*, p. 224.

[2] *Hydrologie du Sahara*, p. 25. Georges Rolland, moreover, regards the surface of the Suf as slightly ascending; see *Ibid.*, pp. 223–224.

[3] See, for example, G. B. M. Flamant, "La Traversée de l'Erg occidental," *Ann. de géog.*, VIII, 1899, p. 234. See also H. Schirmer, *Le Sahara*, pp. 173 ff.

To sum up, the gardens are irregularly distributed along one of those wide strips where the thick accumulations of sand have a flat surface in contrast to the sharp relief of the bordering dunes.

The Gardens of the Suf

The Soafas have taken refuge in the midst of the sands and have patiently formed their gardens of date palms by digging out these masses of sand to a depth of several yards. To be able to plant their trees they have cleared away the sand until they were near the *water surfaces*[1] (or *water table*, as the surface of the ground-water is called), and the roots of the palm trees have themselves found the subterranean water.

Thence comes the strange appearance of the gardens of the Suf. They are surrounded by high banks and are scattered. In these scattered funnel-like holes are grouped from seven or eight to some dozens of date palms. Thus more or less dense clusters formed by the tops of the trees appear scarcely to rise above the level of the sandy camel trails (Fig. 157).

But these hollows thus dug in the sand are in constant danger of being refilled. The dry sand of the desert is so easily moved that at the slightest breath of wind the fine grains are carried into the hollows, and, in spite of the little walls or fences made of the trunks of palm trees, the gardens would soon be filled up and the tall palm trees would soon be buried to their tops if the Soafas were not constantly at work carrying the sand back to the tops of the steep banks. They fill their *couffins*, put them on their heads, climb painfully up the slope, and empty their little baskets upon the top of these unstable banks; and this goes on indefinitely. Those who are richer use small asses loaded with a double *couffin*.

On the other hand, the Soafas do not have to bother themselves with watering their gardens; in the Suf there are neither streams nor springs; the tree itself draws water that is unseen by man. Only now and then do we see wells on the sides of the embankments which furnish water for the inhabitants and their animals or for minor cultivation. The Soafas do not

[1]For the details of these works of excavation, see G. Rolland, *Hydrologie du Sahara*, pp. 222–223.

raise wheat or barley, which must be brought from the Tell. They do, however, carry on some minor cultivation,—onions, watermelons, henna, etc.—and for this they need a certain

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FIG. 157. GENERAL ASPECT OF THE GARDENS OF EL WED

There is seen only the high tops of the palm-trees rising above great hollows dug out of the sand of the desert; all the little black spots seen on the horizon indicate scattered hollows like those in the foreground.

number of wells. Sometimes the water is drawn by means of a chain or by a sweep, called the *khotara*.[1] Certain of these wells are common wells to which everyone may go, and as one goes down the slopes toward them there are seen lines of women and children like those that go down to the banks of the Nile. The women carry large round water jars, while the small girls have smaller jars or carry on their backs goatskin bottles.

[1]This contrivance consists essentially of a long wooden pole, resting in the middle on a point of support; to one of the two extremities is attached a rock or a piece of wood, acting as a counter-balance; at the other extremity is suspended a pouch of skin, which serves as the bucket; the pouch is called in the Suf, as elsewhere in the Ziban, etc., the *delu*. This rustic contrivance, very convenient as the wells are not deep, is very common in many countries, France, Germany, Hungary, etc.; the gardeners of Genoa and Savona make use of similar contrivances which they call "storks." And the Egyptian *shaduf* is of the same sort.

In the Suf, more exclusively than anywhere else, the date palm is the principal object of cultivation.[1] The most important group of these queer palm gardens, these "excavated gardens," is in the neighborhood of El Wed. The gardens have not the same value throughout the Suf, their prosperity depending upon the quality and abundance of the subterranean water. A line of demarcation may be regarded as running in general northwest-southeast; it passes through the very middle of the gardens of El Wed and in El Wed itself the line may be drawn from the *abattoir* on the north to the *borj* (storehouse) on the south. All the gardens situated to the east of this line are considered inferior in quality to those situated to the west; the palm trees of the first group are sold for from $9.00 to $28.00 (50 to 150 francs), while those of the second group bring at least $48 (250 francs) each and sometimes even reach the enormous sum of $96 or $116 (500 or 600 francs). These prices are surprising, but the dates of the Suf are of a rare quality. The hollows in which the trees are planted are naturally overheated and form veritable hothouses which are very favorable to the ripening of the fruit.

Moreover, the price of a product depends essentially upon the general geographic conditions. The farther away a center of cultivation is from all the great cultivated regions, and, like the Suf, lost in the midst of the desert, the more the prices of products cultivated on the spot are likely to rise. These are the characteristics that distinguish the Suf and, as we shall see, the Mzab. We should perhaps go further and give these prices reached by the palm trees of the Suf as an example showing that in these extreme cases labor is the essential measure of value. A product costs more because it has required more labor. If, in the oases of the east, palm trees sell much more cheaply than those of the west, is it because the dates are not so good? Is not that the explanation given by Europeans? Since it is clear that toward the east the subterranean waters are very good and abundant, is it not true that the palm trees are less dear there than in the west

[1] On the distribution of the date palm, see again the study by Theobald Fischer, "Die Dattelpalme, ihre geographische Verbreitung und kulturhistorische Bedeutung," *Petermanns Mitt., Ergänzungsheft*, No. 64, 1881, and the map which accompanies the study.

simply because the sand is more humid than in the west and the trees grow more easily and demand less labor?

The Characteristics of the Human Habitation

It seems that where man gives great care to working the ground, he shows the same care in at least a few other ways and particularly in the art of building. It is certain that there are few Saharan oases where cultivation demands such constant toil as in the Suf, and there are no cities or villages in the Saharan country where the houses are so carefully and we might even say so elegantly built as at El Wed, at Kuinine, or at Guemar.

It should also be said that the very original characteristics of the house in the Suf depend upon the materials which the Soafas have at their disposal. Stone is rare, and the only stones that are found buried in this sea of dunes are very silicious, with curious forms that have long caught the eye of travelers. They sometimes take the form of roses, whence the name "roses of the Suf."[1] The stones of the dunes contain sulphate of lime in sufficient quantity to furnish a very good mortar used in laying the walls. Thus the Suf, though it has only one kind of building material, has it in a unique form that supplies both stone and mortar. Because of the ease with which the blocks are superposed this material lends itself to difficult building.

In all countries, and especially in the Saharan oases, the part of the habitation most difficult to construct is not the walls but the roof (Chap. III, § 1).

The walls may be and often are built—as at Biskra, at Laghuat, or at Bu-Saâda—of simple bricks of clay dried in the sun. But the overhead covering of the house is a much more difficult problem to solve. Fortunately the two opposing walls may be joined by trunks of palm trees cut into three or four pieces and the problem of a roof is often solved in the Sahara of southern Algeria and Tunis, as also in Egypt, by placing palm stalks and dried earth upon this skeleton of a covering.

The stone of the Suf has not only permitted the building of very solid walls, but also, above the four walls, hemispherical cupolas, so that all the houses, even the most humble, end

[1] This monograph on the Suf and the Mzab was published in *La Géographie*, 1902, with twenty illustrations, nine of which are in this book; the map, Fig. 155, p. 418, is new.

above in good architectural forms. With such materials the inhabitants of the Suf are indeed past masters in the art of building. Above their four walls they make pendentives and

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FIG. 158. A HOUSE WITH CUPOLA, BETWEEN EL WED AND KUININE

then raise their hemispherical vaults directly without taking the trouble to construct supporting arches; tightly drawn cords give them their dimensions and directions. One can easily imagine what skill the builder must have in order to attain the form of a cupola with such perfection. The cupolas have at the most a diameter of 6 feet 6 inches (2 meters), and at the least of 4 feet eleven inches (1.50 meters). A group of two, three, or four cupolas belong to a single house. The small rooms corresponding to each cupola communicate with each other by a very regular semicircular arch.[1] Often at the upper central point of the vault rises a small truncated cone.

Such is the typical house which characterizes this group of oases, and which adds another striking feature to the appearance of the Suf. All these houses formed of cubes of masonry capped with perfect hemispheres have a geometrical regularity of alignment that is surprising, especially in the desert (Fig. 159, general view of Kuinine). From a distance they resemble cities of beehives, immense colonies of bees.[2]

[1] "These little houses have only a single opening with no door to close it; all those belonging to the same family open on a closed court with a stone wall the same height as the rooms" (Com. A. Monségur, "Étude sur la province de Constantine," *Rev. de géog.*, December, 1899, p. 427).

[2] In southern Tunis also one meets with very clever and curious constructions. L. Pervinquière, the geologist of Tunis, describes them in an article which is in every way remarkable, "Le Sud-Tunisien," *Rev. de géog. ann.* III, 1909, pp. 395–468. The storied houses of the *ksar* Medenine are quite different from those of the Suf (see, in Pervinquière, p. 455, Fig. 23); but it is interesting to compare general views of this *ksar* (p. 454, Fig. 22) with those of the cities of the Suf. Finally, one will find in the study mentioned some information on the troglodytes of south Tunis.

The Distribution of the Settlements; the Inhabitants

The settlements follow the gardens. The main center of the houses is near the main group of gardens—for example, El Wed, whose *kasba* is to-day occupied by the Arab Bureau and the garrison. El Wed has at least a thousand cupolas, the tall minaret of a great mosque rising above them. The city, which is situated at the extreme southeast, commands the group of oases of the Suf and there the most important market is held. A little north and west of El Wed are the two centers, Kuinine and Ourmes (more exactly Bu-Ourmes). Toward the north, the ancient fortified village of Guemar, which still important, ends the strip of small western

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Fig. 159. General View of a Type of Settlement in the Sûf, at Kuinine
Note the rows of cupolas which cover the different rooms of each house

centers. On the east, strung in a line, are the little clusters of houses of Z'gourn, El-Behima, and Dèbila. One more recent than the others, Sidi-Aoun, is only half a century old.[1]

[1]It is well to mention also, as connected with the same geographic type of human settlement, the very small groups of houses of Dmirini and of Taibet-el-Gueblia; Taibet, for example, does not, properly speaking, form part of the Suf, but is much farther south, about 21 miles (35 kilometers) to the east of Tugurt; but it is a group of houses situated in the midst of the dunes in the same natural environment as the little cities of the Suf; the gardens there are similar to those of the Suf; and the houses there are crowned with cupolas identical with those of the Suf.

Finally, south of El Wed, is a special center, Hamich, whose complex character it is important to note. Hamich is intermediate between the fixed, sedentary settlement, such as those mentioned above, and the transient settlement, the agglomeration of nomads' tents. It is in truth a vast camp of nomads whose tents spread over more than 4.9 miles (8 kilometers). The camps are established beside gardens which are exactly like those of which we have spoken above. The extraordinary fact is that the tents are accompanied by small houses built after the model of those of El Wed or of Guemar; but they are not *dwelling-houses*, they are *storehouses*. During the winter the Arab nomad comes and camps in front of his storehouse, while he and his family live in a tent or in a hut of palm leaves.

The Shamba nomads cannot bring themselves to live in houses. The following facts illustrate this point: South of the Suf a number of *borjs* were built and it was desired to intrust the guarding of them to some Shambas; but the Shambas are inferior guardians, for it is very difficult to get them to live within the *borj*. They are willing to use the buildings and the rooms of the *borj* as storing places while they themselves pass the night outside in a tent or in huts made of *jerid* (palm branches and leaves) or of branches of *retem*. In any case, if one of the Shambas finally consents to live within the *borj*, he is never willing that his family should leave the tent.

The populations of the Sahara have been divided into the two great opposing and often hostile classes of nomads and sedentary peoples. But it goes without saying that, along with these exclusively sedentary or nomadic groups, there are certain groups which show the characteristics of both classes. The oases of the Suf offer us a rather rich collection of such intermediate groups.[1]

It is a small detachment of the great family of the Shambas, those nomads *par excellence*, that comes every year and establishes itself near the cupola-capped storehouses of Hamich. These Shambas are the owners of a few gardens. They have

[1] It is well to connect these facts with those which we have mentioned in section 6 at the end of chapter IV.

not planted palm trees, but bought them. They are still nomads, but nomads who own palm trees and who build houses like the dwellings of sedentary peoples to serve as granaries.

The Ashesh and the Messâaba are nomadic tribes that have become in part sedentary. They are to-day cultivators and shepherds and have at the same time gardens and herds. The Ashesh and the Messâaba form the bulk of the population of El Wed. Among the inhabited centers of the Suf, El Wed is somewhat exceptional. It has not the character of the ancient *ksur* of sedentary people; it has not the same appearance as Guemar or even Kuinine; it is built over a wider space, with less care to crowd the houses together and with less thought of defense. El Wed is not gathered within walls like Guemar. There is between Guemar and El Wed the same difference that there is in other lands between an ancient city with a girdle of walls and a more modern city that has had a freer development.

A great tribe that is entirely sedentary, the Uled-Saud, has peopled almost all the centers of which we have spoken—Kuinine, Ourmes, Z'goum, Guemar, El-Behima, and Dèbila. These sedentary populations are chiefly cultivators, but they are also merchants. The inhabitants of Guemar manufacture carpets, the famous carpets of the Suf, and sell them as far away as the Tell.

Finally, a large number of the inhabitants of the Suf, not finding the means of subsistence in the Suf where natural conditions are so unfavorable to cultivation, emigrate to the Tell, to Constantine, Philippeville, and Bône, and here form that class of economical and poor laboring people who furnish the unskilled labor—porters, peddlers, etc. They are the Uled-Passa. They remind us of other emigrants in the great European cities who are water-carriers, floor-polishers, porters,[1] etc.

Thus the oases of the Suf form a complete whole from the point of view of the Arab tribes. They contain a few Arabs who are purely nomadic, who have remained nomads, besides

[1]In an article on the Jebel-Demmer (*Ann. de géog.*, May 15, 1897, pp. 239–254) Paul Blanchet describes the Matmata and the Duiri, whose dwellings are so curious. The Duiri and especially the Matmata live in the Tell also; from the north they come to Tunis and Sousse to fulfill the modest functions which the Soafas fufill in the Algerian Tell.

other nomads who have become sedentary but a short time ago, and also of course a majority of inhabitants who are purely sedentary.

The administrative organization of the Suf is not based entirely upon a division by tribes nor upon a division by inhabited centers; it has aimed at depending upon local conditions rather than at uniformity. The inhabitants of the Suf are grouped in three tribes under the control of *kaids*, and in four *sheikhats* under the control of *sheikhs*. The three tribes are the Ashesh, the Messâaba, and the Uled-Saud, and the four *sheikhats* are those of Guemar, of El-Behima, of Dèbila, and that of the Shambas. It is according to these natural groupings that the Arab Bureau at El Wed draws up the tax lists.

The following table gives some interesting figures on the number of animals and trees belonging to each of the groups:[1]

Tribes	Number of Persons	Camels	Sheep	Goats	Palm Trees
Ashesh	4,732	2,987	14,575	14,903	38,086
Messâaba	4,496	2,123	8,225	8,305	27,107
Uled-Saud	7,386	375	.....	2,012	65,085
INDEPENDENT SHEIKHATS					
Guemar, *ksar*	3,682	509	346	1,118	37,005
El-Behima, *ksar*	1,197	54	29	214	13,912
Dèbila, *ksar*	854	63	.....	229	9,307
Shambas, *tribe*	273	868	1,275	1,083	1,650
	22,620	6,979	24,550	27,864	192,152[2]

A commentary upon this table is not without interest. The Uled-Saud and the people of Guemar, El-Behima, and Dèbila represent the sedentary part of the population. They number 13,119 and own all together only a thousand camels (and it must be further noted that more than half of these camels belong to the inhabitants of Guemar, who are the most interested in commerce and have the greatest need of camels for transportation). On the other hand, they own 125,309 palm

[1] By the authority of Captain Davy de Verville and the kindness of Lieutenant Gascuel, these interesting figures concerning the number of animals and trees belonging to each of the groups, were obtained from the local Bureau for the year 1899.

[2] This is the total number of palm trees giving revenue (since they have been taxed) in the year 1899. Comparing this number with the figures for 1875, according to the "État détaillée des oasis de l'Oued-Souf," which G. Rolland has given in the "Appendice statistique" of his *Hydrologie du Sahara algérien*, p. 323, there were in the Suf in 1855, 154,359 palm trees being taxed, which means, if the figures are correct, an increase of 25 per cent in a quarter of a century.

trees, or almost two-thirds of all the palm trees in the Suf. But the small group of 273 nomadic Shambas own only 1,650 palm trees, while they have 868 camels. As to the Ashesh and the Messâaba who form the main part of the population of El Wed, they represent, as we have said, a transitional type as nomads who have become in part sedentary and are both cultivators and shepherds. They number 9,200 and, while owning about 65,000 palm trees, also possess rather large herds (more than 5,000 camels, more than 22,000 sheep, and more than 21,000 goats).

All these different populations, however, take from their like geographical environment certain like characteristics. We speak commonly of the inhabitants of the Suf, of the Soafas, in spite of all the differences from *ksar* to *ksar* and from tribe to tribe to which we have just called attention. It would be childish to make all the distinctive manifestations of human activity depend upon natural conditions. The attempts to set out with a sort of fatalistic determinism to explain everything by geography end in such absurdities that they run the risk of ruining the conception of a certain dependence of man upon nature, a dependence that is relative and limited, or conditional. It is, however, important to bring clearly to light the facts of human life which manifestly spring from geographic conditions. The sandy environment of the oases of the Suf furnishes a typical example.

It is generally known to what a degree the wind, creator and fashioner of dunes, sets its mark upon the sands; the form and direction of the dunes show the force and the direction of the winds. There is a also a network of ripples in the sand which, when closely examined, is only a network of miniature dunes due to minor currents of air. The same effect is seen on the surface of a sheet of water roughened by the wind.[1]

Likewise the "writing" of the rain remains for several days on the sand, if the wind does not blow; and thus the sand keeps

[1]The study of these "ripples" of water and these "waves" of sand, as well as of all similar movements, is in the process of being established as a branch of geographical science, under the name of *kymatology* (κῦμα, wave); see, for example, Otto Baschin, "Die Entstehung wellenähnlicher Oberflachenformen, Ein Beitrag zur Kymatologie," *Zeitschr. der Ges. für Erdkunde zu Berlin*, XXXIV, 1899, No. 5, pp. 408–424; and the various publications by Vaughan-Cornish (see *Ann. de géog., Bibl. de 1900*, No. 86). See also Jean Brunhes, "L'Allure réelle des eaux et des vents enrégistrée par les sables," *La Géographie*, XIV, 1906, pp. 193–210 and Figs. 22–31.

the traces of almost everything that passes over its surface—the six feet of an insect, or the sinuous line of a serpent, or, more pronounced because of their greater weight, the imprints of the feet of men or animals. The inhabitants of the Suf are accustomed to observe and recognize these imprints. They know the feet of their own camels and of those of their neighbors. When they see the tracks of a caravan in the midst of the dunes, they easily make out to what tribe the caravan belongs. The men of El Wed let their camels run free to pasture and when they have need of them they find them by following their tracks over the sand. In short, among the thousand tracks which cross each other on a trail or on a village square and which seem to us absolutely indistinct, the skillful Soafas can find the ones they seek.

This exceptional facility in following the tracks of any passer-by is doubtless the reason that at El Wed and in all the Suf thefts are less numerous than elsewhere. The Soafas are no better than the other natives of the Sahara; they are even considered as inferior to many of them and as cowards by nature; but this respect for the property of others, which is extraordinary in the desert, is there a geographical fact. The robber can be too easily pursued and caught. Moreover, certain men devote themselves especially to this minute observation of tracks left in the sand. They are known as "trackers" and are held in high respect. When a crime is committed, a murder for example, these trackers are of the greatest assistance to the police; they find the criminal with incredible speed and certainty.

In the oases of the Suf a man cannot go anywhere, cannot take a step, without leaving on the sand the trace of his passage. This geographical fact is too general and too unavoidable not to have some influence upon human activity.

3. THE SHEBKA OF THE MZAB. THE WELLS AND THE GARDENS. THE HOUSES AND THE CITIES. THE MOZABITES

The Environment: The Shebka

The dunes, being reservoirs of water, have in places a rather abundant vegetation and form pastures for the camels and the sheep. When, leaving the dunes, one penetrates the stony

desert of the *hamadas*, it seems as if one were leaving a rather hospitable region and facing for the first time the true desert. On the large, indefinite, stony patches of the *hamadas* there are no large tufts of plants; only in the gullied bottoms of the dried-up *wadi* a few scattered sprigs of vegetation may furnish meager forage for the limited herds of sheep that find difficulty in living there.[1]

The Shebka of the Mzab is formed upon limestone and its broad surface is yellowish white, harsh, and bare. It has been eroded and fashioned by the waters, especially in the northeast, so that it appears as if cut into confused and irregular series of steep-walled ravines which the natives have naturally compared to the entangled threads of a net—the word *shebka* means "net."

To find oases in the midst of the Shebka seems more astonishing than to find them in the midst of the dunes of the Suf. It is well not to forget that the Shebka is from 1,900 to 2,300 feet (600 to 700 meters) above the level of the sea, while no point in the Suf exceeds 300 feet (100 meters). The Shebka is at a very high level in comparison with the depression of the Wad Rir' and the ground-water surface that marks that depression.

One must have traveled on foot over the wrinkled and hillocky surface of the Shebka[2] or have seen the steep and sterile sides of the smallest slopes in order to have a clear idea of the desert conditions. Between Berrian and Ghardaïa, for a

[1] In *Le Pays de mouton*, we read (p. 232): "There are about 33,000 sheep within the limits of Ghardaïa. In proportion to the immense extent of the country, this flock is quite small as to numbers. However, one can scarcely hope to see it increase, because of the poverty of the pasture lands." We must remember that the limits of Ghardaïa comprise not only the region of Mzab, but also the country of Wargla, of El Golea, and of Hassi-Inifel (it was only in 1897 that the capital of the extreme south, which was originally at Ghardaïa, was transferred to El Golea; see Augustin Bernard and N. Lacroix, *Historique de la pénétration saharienne*, p. 125). The number, 33,000, seems to me less than the true number of sheep; but when it is a question of wandering flocks, everything depends upon the time of year which one has chosen, and the statistics are even more liable to error than usual.

[2] "The soil, consisting of dolomites, yellow-brown on the outside and white inside, of crystalline structure and well stratified, presents at the surface fragments of sandstone made of quartz, grayish-black, often numerous enough to form great blotches on the earth, which attract the attention from a long distance. The rough rock, sharp-edged and hard, is sometimes remarkably polished, sometimes curiously chiseled, carved, hollowed, transformed in places into veritable lace-work. Various meteorological agents play their part in such modifications. Chief among them are the wearing away by sands which the winds carry, the dilations and contractions resulting from sudden changes of temperature . . . . . and the action of certain rains, heavily charged with carbonic acid" (Dr. Ch. Amat, *Le M'zab et les M'zabites*, p. 70).

distance of 27 miles (44 kilometers), it was impossible to find a single source of water supply where a relay post for the stage service could be established.

The Wells and the Dams of the Mzab

Fortunately there are in the plateau of the Mzab some underground stores of water where the limes and the marls which lie beneath them come in contact.[1] These water surfaces are, however, rather deep down, and naturally it is easiest to dig wells to reach them in the beds of the *wadi*. Of the seven oases of the Mzab, five are close to the *thalwegs*[2] of a single *wad* and its affluents; these five are Ghardaïa, Mélika, Beni-Isguen, Bu-Nura, and El Ateuf. The two other oases, Berrian and Gerrara, are likewise situated in depressions, as well as the more southern oases of Metlili, which resemble in character the oases of Mzab proper. But, even in the depressions, one is often far from the subterranean water, and the wells of the Mzab vary in depth between 26 and 180 feet (8 and 55 meters).[3]

The subterranean waters of the Mzab are not artesian; the water must be drawn up from depths of 98, 130, 165 feet and more (30, 40, 50 meters).[4] How will it be possible to keep up vast gardens under such conditions, when all the water must be drawn from such a depth? Will men have the courage and perseverance to carry on such a task unceasingly? The Beni-Mzab, heretical Mussulmans, beaten and hunted, have established themselves in the midst of the Shebka and have had and still have the tenacity and the energy to draw this deep-lying water. All life is dependent upon water; the first and essential task is to obtain water. It is then with

[1]See G. Rolland, *Hydrologie du Sahara*, p. 34. Moreover, according to the investigations made by J. E. Lahache, the water in the wells of Mzab is some of the best in the whole Sahara (*Étude hydrologique sur le Sahara français oriental*, Paris, 1900, p. 41).

[2]The lowest line of drainage of a valley is known technically as a *thalweg*, literally *valley-way*. *Valley floor* is nearly equivalent for the purpose of human geography (W. S. Slichter, Water Supply Paper, No. 67, U. S. Geol. Surv.).

[3]According to Ville (whose *Exploration géologique du Beni Mezab, du Sahara et de la région des steppes de la province d'Alger* [1872] it is always well to consult and to re-read), a well of Mélika—which is moreover the deepest well in all the Mzab—is almost 233 feet (71 meters) deep and contains 12 feet (3.72 m.) of water (p. 50).

[4]The Mozabites call a great many of the watering places of the Shebka, *Ain* (for example, *Ain Massine*, *Ain Goufafa*, etc.), holding the belief that the water is furnished by some sort of springs. It is the same in other cases of the Sahara—as in the oases of Dakhleh and Khargueh, where they give the name *ain* to artesian wells.

the wells (*hassi*) and the gardens that a human geographical study of the oases of the Mzab must begin.

The means of drawing the water are well adapted to the surroundings. The great depth has caused the principle of the lever applied in the *khotara* and in the Egyptian *shaduf* to be rejected. Instead of a pole working on a lever, a rope and pulley are employed. At the end of the rope is attached a receptacle consisting of a leather sack holding from 10 to 13 gallons (40 to 50 liters). Instead of winding the pulley rope around an axle, a tiresome task that could be performed only by a man, it is drawn over the pulley and away from the well. This can be done by man or animal—negro, donkey, or camel. The deeper the well, the farther along the path must the man who does the drawing go. The Mozabites have arranged this path on a slight incline, thus reducing the effort somewhat since the drawing agent is going slightly down hill as the sack is being raised.[1]

At certain points the deep pockets, rich in water, are particularly scarce. At Beni-Isguen, for example, water points are much rarer than at Ghardaia; there are only three or four wells that always have water even in times of drought. These belong to several proprietors who sell hours of watering to others who are cultivators. These wells are used constantly, even during the night, and the water is drawn by means of two animals which, with their driver, go at a trot.

If we wish to have a clear idea of the amount of work involved in this method of obtaining water in spite of its ingenuity, we must not forget the weight of the sack containing from 10 to 13 gallons of water nor the minimum of time required for such a process. In the Mzab it is necessary to draw water without ceasing in order to supply a thirsty soil that so quickly drinks up all the water given to it.[2]

The greatest precautions are therefore taken to husband carefully a supply obtained with so much difficulty. The

[1]This type of well is really very practical for drawing water from great depths, and to-day one finds that it has spread and has become common even beyond Mzab, for example, in the whole Tunisian Sahel. It is also known in India, where the rope of the pulley is often worked by yoked cattle.

[2]One surmises also what the intensity of evaporation is during the day; on this subject, see Ch. Amat, *Le M'zab et les M'zabites*, p. 214. In a general way, see the whole chapter devoted to "Météorologie" (chap. IV).

Mozabites strive as best they can to prevent infiltration by lining the little canals, the little *seguia* which carry the water from their wells to their palm trees. This is the only place in the Sahara where we have seen the natives take such a precaution. It is where water is scarcest that it is treated with the most jealous care.[1]

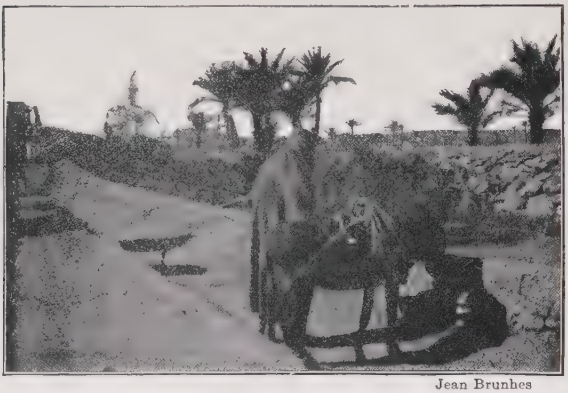

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FIG. 160. HOW THE WATER NECESSARY FOR CULTIVATION IS OBTAINED IN THE OASES OF MZAB

There is seen at the top of the path the uprights of the well, and the stream of clear water from the previous drawing is distinguished; when this is emptied the man and the donkey, at the end of their path, return for the next drawing.

Thus the ditches are not merely dug, but, in a sense, *built*. It is important to note how the digging of wells as deep as theirs, with the upper part generally walled for several yards, and the building of the two uprights of masonry upon which to rest the beam for the pulleys,[2] impose upon the inhabitants of the Mzab habits of serious building. Now, according to the Arab Bureau at Ghardaïa, there are at least 3,300 wells of this sort in the Mzab.

Further, in order to obtain and distribute water, the Mozabites not only dig wells but they build admirable dams of masonry. They set too high a value on water to neglect any means of obtaining it. Showers are rare in the Mzab; in rainy years there are only two or three, and entire years pass without a single drop of water from the atmosphere. A. Coyne says

[1] Georges Rolland has with good reason supported the fight against infiltration in Wad Rir'; at his instigation, and under the direction of MM. Cornu and Bonhoure, the little irrigating trenches have been gradually paved with earthen tiles made and baked there in the oases of Sidi-Yaya, of Ayata, and of Urir. It is interesting to compare this innovation with the traditional usage of the Mozabites. See Brunhes, *L'Irrigation dans le péninsule ibérique et dans l'Afrique du Nord.*

[2] The Mozabites came from Wargla, whence they were driven out; and at Wargla they had acquired the habit of boring artesian wells, the walls of which had to be stone-work because of the weakness of the earth strata; see Paul Blanchet, "L'Oasis et le pays d'Ouargla," *Ann. de géog.*, March 15, 1900, p. 142.

very truly that "for the Beni-Mzab the year may be characterized briefly: the river flowed or it did not flow."[1] However, in anticipation of exceptional rain floods the Mozabites have built with their usual care works of considerable importance. Thus, in the single oasis of Ghardaïa, six large retaining dams, several of them of masonry, cross the *thalweg* from side to side so as not only to obstruct the underflow but also to gather up the run-off—the exceptional treasure of an abundant rainfall.[2]

Above the oasis of Ghardaïa a large dam, the Bushen, is constructed to store the water and form a sort of large lake in the exceptional case of a flood. The reservoir is often absolutely dry, yet everything is built as if it were to be in continual use. A subterranean gallery with manholes, after the fashion of the *feggaguir* of the Tidikelt, conducts the water, when there is any, from Bushen to the oasis and allows a moderate and temperate flow of this unusual and temporary treasure.[3]

[1] "The statistical and chronological documents kept by the *tolba* of Ghardaïa record, for the period from 1728–1872, only twelve great risings for the Wad-Mzab, or one rising every 13 years" (Ch. Amat, *Le M'zab et les M'zabites*, p. 217).

[2] For detailed information on these dams and the various other dams of Mzab, see Ch. Amat, *Le M'zab et les M'zabites*, pp. 54 ff.; and take note especially of the technical descriptions, exact and minute, which Ville has given of them in his *Exploration géologique du Beni Mezab*, etc.

[3] One still finds some *feggaguir* at El-Golea and in several other oases, such as the little oasis of Bu-Kais to the west of Sfisiffa (De la Martinière and N. Lacroix, *Documents pour servir à l'étude du Nord-Ouest Africain*, II, p. 402); and one finds some also in the oasis of Menchia in Nefzaua (South Tunis); one can compare with the *foggara* the *shegga* of Ed-Dis, a little oasis situated near Bu-Saâda (the *shegga* is a trench in the rock for conducting water, sometimes making the water pass in a tunnel under the houses). But the Saharan province where the *foggara* is the chief device for conducting water is Tidikelt. These are oases to be counted among the most important, whether from the political or from the economic point of view. The *feggaguir* allow the conducting of subterranean water in streams to the gardens. An original *foggara* can become, if the main source of water is abundant, the central branch of an infinity of *feggaguir*. The main *foggara* belongs to the community, and all those who have worked to increase its producing power have a share in it in proportion to their work. There is still a subterranean canal system of the *feggaguir* type in use at the foot of the Atlas Mountains of Morocco, on the Atlantic slope, for example, in the great oasis of Marrakesh. There they call these subterranean conduits *shattara*, plural *shatatir;* Theobold Fischer has described at length their ingenious construction. (See "Wissenschaftliche Ergebnisse einer Reise im Atlas-Vorlande von Morokko," *Petermanns Mitt., Ergänzungsheft*, No. 133, pp. 86–89). It is moreover a process known and practiced in all the deserts of the ancient world: *kanat* in Iran, *sahrig* in Yemen, etc. What made the natives build such costly systems for the circulation of water beneath the earth? The first to treat this problem very clearly was G. B. M. Flamant. E. F. Gautier discussed it in his turn, mentioning the fact that in Tuat alone there are at least 1,200 miles of *feggaguir*, and noting especially "the disproportion between the great size of the work and the small resources at the command of those who executed it"; his theory is that this could hardly be the result of a preconceived plan, but was born of increasing necessities ("Études Sahariennes," *Ann. de géog.*, XVI, 1907, p. 66). Similar reservoirs have been built in many other desert situations. Back of Mollendo, Peru, there is an expensive dam to obstruct the surface flow down ravines that have living streams but once in several years.

But, more surprising still, water is so valuable that here and there even on the arid and inhospitable slopes of the Shebka little dams of masonry are seen built upon the rough rocks that seem never to have known the friendly trickling of water. These little retaining dams are meant to gather up the water from the smallest local showers and form one of the most striking peculiarities of the Mzab.

The Gardens of the Mzab

What obstinate toil is implied by such enterprises and to what costly cultivation they must lead! The Mozabite is a skillful gardener who spares neither care, time, nor trouble.[1] He, as well as the Soafa, knows the value of fertilizers and he uses systematically all of the few fertilizers that he can obtain. The gardens of the Mzab are better cared for, richer, and also more costly than anywhere else. They are not gardens for profit, but true luxuries.[2] In the Mzab, as in the Suf, the price of the tree no longer depends upon what it produces but upon the work that it has cost and represents. In the Suf, as we have said, a palm tree costs all the way from $10 up to the incredibly high price of $120 (50 to 600 francs); in the Mzab it costs easily from $60 to $80 (300 to 400 francs) and goes as high as $100 or $120 and even $200 (500, 600, 1,000 francs). A palm tree which is worth an average price of $50 or $60 (250 or 300 francs) does not produce on the average more than $2.00 worth (10 francs) of dates per year.

It is to be noted that the only profitable palm groves owned by the Mozabites are those outside of Mzab, particularly in Wargla.[3]

And yet what magnificent vegetation in these gardens of

[1]It was a Mozabite who first introduced the palm to Orléansville, by taking there a quick-growing species from Mzab which could come to maturity under a northern sky. The Mozabites fertilize their palms with the pollen of the male blossoms saved from the preceding year. It is very natural that they should have had the idea of accomplishing fertilization at Orléansville with flowers brought from the South.

[2]Captain Cauvet gives these calculations: it cost about $220 a year to keep up a garden of fifty palms, and such a garden can bring a maximum return of barely $200; for instance, some $100 for dates, $40 for fruits, $30 for summer vegetables, $20 for winter vegetables and cereals, and about $4 for various products such as grass, wood, etc.

[3]Many of the million palm trees in the great forest of the different oases of Wargla belong to the Mozabites. See Paul Blanchet, "L'Oasis et le pays d'Ouargla," *Ann. de géog.*, March 15, 1910, p. 153.

the Mzab! They are veritable thickets that make one think of climates where the humid heat gives to vegetation a spontaneous exuberance. Between the tall palm trees are planted enormous fig trees with multiple trunks hidden under the foliage of their spreading branches. Pomegranate, apricot, and peach trees form a veritable underbrush beneath the palms, while huge vine stalks send their branches in all directions, their shoots clinging like creepers to the trunks of the palm trees. The sun can hardly penetrate these arbors of branches and leaves, and, while in other Saharan oases barley and beans are cultivated at the foot of the palm trees, here they are often relegated to the border of the palm grove, forming around the gardens a fringe of brighter green.

There are, of course, some differences between the several oases of the Mzab. For example, at Beni-Isguen the *wad* is more confined between the two rocky and arid slopes. There is less room between the *wad* and the mountain, with the result that, since the barley, beans, carrots, radishes, and *felfel* (a red pimento very much liked by the Arabs) cannot be sown on the edges, they are sown under the palm trees. The fruit trees are therefore much less numerous and do not form such dense thickets as at Ghardaïa. In short, the impression produced by the Mzab is very complex.

Throughout the Mzab there are sights that remind one of Egypt. Doubtless the first and chief reason of this is to be found in those steep slopes of arid rock of the valleys of the Shebka, the colors of which, yellow, tawny, or red, according to the time of day, recall the long Libyan and Arabian cliffs, the bare and colored slopes that border the valley of the Nile. Then, too, it often happens in the Mzab that cultivation stops at a more precise limit than in other Saharan oases. At Berrian in particular little squares of green barley form minute oases entirely surrounded by rocks and sand. The continuous creaking of the pulleys of the *hassi* (wells) reminds one also of the creaking of the Egyptian *sakiyehs;* and those wells of Beni-Isguen, where the proprietors divide the hours of use or sell them to others and where the work goes on night and day, make one think involuntarily of those *sakiyehs* of Upper Egypt which the Nubians own in common and to which each

comes in turn with his animal to draw the water, so that there is no interruption in the important work.

But, on the other hand, mixed gardens thick with foliage, like those of Ghardaïa and Metlili, carry our thought far from the flat and homogeneous fields of cotton or sugar cane on the banks of the Nile and call to mind the pleasure gardens of Cairo or Alexandria.

The Houses and the Cities of the Mzab

The Mozabites, who are such skillful builders, have in fact at their disposal an admirable mortar, the *timshent*. A dark, reddish-brown limestone mixed with earthy gypsum and called *kaddan* gives, when burned, this *timshent*, which has a pinkish color and as a mortar has the double advantage of drying very quickly and of having a solidity that withstands any test. It "sets" rapidly and has the qualities of cement. The Mozabites, therefore, like the Soafas, have very good facilities for building. Since they live on the rock, they have available a large supply of stone, in addition to the valuable *timshent*. It should be noted that again in this case the work demanded of man in the geographical environment of the Mzab is much more laborious and costly than that of the Suf. The *timshent*, like lime, is a product obtained by burning. In a country like the Mzab where wood and other fuels are scarce the burning of the *kaddan* means much labor. The people burn *drinn* or *retem* and have to go far to gather these tufts of fuel. But the Mozabites are accustomed to laborious and continuous effort and their dams give proof of a perfection in building also to be seen in their houses and cities. The houses of recent times also seem higher than the old. From a distance some of them resemble those quadrangular towers of masonry that rise above the gates of our European cities.

The Mozabites have always built houses of stone, consisting of two stories and constructed with much care.[1] The ground floor opens on an inner court or the rooms of the first floor open on a terrace in the form of a court and these openings are

[1]Some houses are of pisé work, but this is the exception. The stone house ceases farther south: "The houses of this little city [El Goléa] are different from those of Metlili; they consist of four earthern walls covered by a roof of palm branches" (Duveyrier, "Coup d'œil sur le pays des Beni-Mezab et sur celui des Chaanba occidentaux, *Bull. de la Soc. de géog. de Paris*, 4th series, XVIII, 1859, p. 239).

generally arcades with semicircular arches (Fig. 163, p. 441), of which they are very fond. The market square of Ghardaïa is bordered with such arcades (Fig. 161). The Mozabites make the arches by means of bent palm branches upon which they place the *timshent*, afterward removing the branches.[1]

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FIG. 161. THE MARKET SQUARE AT GHARDAIA WITH IRREGULAR SEMICIRCULAR ARCHES

The Mzab house is on the whole less original than the Suf house, but when grouped together the general appearance is not comparable. The Mozabite city has a physiognomy entirely its own (Figs. 162, 163, and 164).

The seven cities, eight if we include Metlili, in spite of their differences have a family resemblance which they owe not only to the large number of arcades and to their notched walls of *timshent* but also to the tall minarets of their mosques, to those *somars* in the form of obelisks which are built of *timshent* and of which the red color is as characteristic as the form.

Mélika is built like a fortress on the edge of an escarpment of the Shebka, crowning it with a horizontal strip of white and red buildings; and above this strip rises the red obelisk of the mosque (Fig. 164). Beni-Isguen extends from the top of the slope, where there is a high gate, to the bottom of the *wad* in two stages, the minaret rising midway. But several of the Mozabite cities have been grouped upon isolated hills. This is true of Gerrara,[2] Bu-Nura, Berrian, the *ksar* Metlili, and especially Ghardaïa, the chief city of the Mzab.

[1]Amat (*Le M'zab et les M'zabites*, p. 130) seems to say that the Mozabites also built vaults without making use of girders, but he is not very explicit.

[2]Gerrara is built, at the edge of the Shebka limestone, on a peak of sandstone. For the history of Gerrara see A. de C. Motylinski, *Guerrara depuis sa fondation* (translation of a narrative edited by Si Mohammed ben Chetioui ben Slimane of the Cheurfa of Gerrara), Jourdan, Algiers, 1885.

None of the cities of the Mzab has a more striking situation and appearance than Ghardaïa. It is built upon a rocky island

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FIG. 162. GHARDAÏA, THE PRINCIPAL CITY OF THE M'ZAB, SEEN FROM THE SOUTHEAST

Compare this picture of Ghardaïa with that of Mélika (Fig. 164)

that rises in the midst of a valley. Its light-colored, sunlit houses, mingled with the dark shadows of the arcades and separated by narrow circular streets, rise above each other in harmonious strength and, to crown this confused yet ordered and aspiring mass, at the very top rises the highest of the minarets of the Mzab, seeming higher still because of this compact pedestal of houses surrounding and supporting it.[1]

Evidently there are some differences between the various oases of the Mzab. At Beni-Isguen, as we have already said, the *wad* is much narrower than at Ghardaïa and the inhabitants of Beni-Isguen have built their houses on the edges of the slopes rather than at the bottom where they would have run the risk of being inundated in time of flood.

[1] See the plan of Ghardaïa in 1882, on the "Carte des Kzour du M'zab" which accompanies the article by Dr. Huguet, "Dans le Sud-Algérien," *Bull. de la Soc. de géog.*, 1899.

The Mzab presents another curious fact with regard to the human dwelling. Not only does the Mozabite live on the products of his gardens but he passes half his life in these gardens. Everyone owns, besides his town house in one of the villages we have named, a house in his garden. Here he lives with his entire family during the hot months, often remaining more than half the year, from May to the first of December, and living chiefly on the dates, vegetables, and fruits that grow on the spot. He thus has two houses, a town house and a country house. While the town houses are grouped close together, the country houses are scattered in the gardens, almost hidden

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FIG. 163. GHARDAÏA, SEEN FROM THE TOP OF THE MINARET OF THE MOSQUE

The houses form terraces up the slope of the elevation which is dominated by the mosque. At the left is a type of interior court bordered by arcades.

under the palms and the branches of the fruit trees. They are built, however, in the same way as the town houses and, like these, often have a second story.[1]

[1]The Duiri of South Tunis also build country houses in their gardens for the summer, but these are rudimentary houses; they are composed of four walls without a roof. See P. Blanchet, "Le Djebel Demmer," *Ann. de géog*, May 15, 1897, p. 245.

Separate mention should be made of the curious settlement of Metlili. South of the oasis of the Suf we have seen that curious camp of Hamish where the nomads pitch their tents

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FIG. 164. MÉLIKA, SEEN FROM THE SOUTHWEST

near the gardens of the Suf type and in front of *desheras* (granaries) built exactly like the houses of the sedentary Soafas.

South of the oases of the Mzab the settlement of Metlili marks a transition analogous to that of Hamich. Here also nomadic Shamba[1] have gardens entirely similar to those of the sedentary inhabitants of the Mzab and watered by wells of the same type. These nomads pitch their tents in their gardens, near summer houses, which are built in the same way as in the Mzab and, as in the Mzab, are scattered in the midst of plantations.

To explain this curious combination of nomadic and sedentary life there is a tradition that there was once an exchange of sixty families between the little town of Mélika and the *ksar* of Metlili: sixty Mozabite families are said to have settled at

[1]Nomads of the Shamba-Berezga: the Ulad-Allush and the Ulad Abdelhad. (The *Tableau des communes*, etc., gives to the latter the name of Ulad Abdelkader.)

Metlili while sixty Shamba families were received at Mélika.

When one has come to know the great difference in the Sahara between the nomad and the sedentary person, one is baffled by the complexity of such facts as are presented by these transitional types, like Metlili in the Mzab and Hamish in the Suf. Is it a case of the power of an exceptionally superior cultivation (sedentary) imposing itself upon those who despise cultivation (nomads)? It would be rash to give this as the only reason. What is certainly true is that human establishments in the desert show much greater cultural complexities than is generally believed, and this is a new and exact confirmation of all that has been said in chapter IV of nomadism and semi-nomadism.

Let us glance at the appended table, which is drawn up on exactly the same plan as the preceding table for the oases of the Suf and based upon figures dating from 1896:[1]

The Seven Cities of Mzab	Number of Persons	Camels	Sheep	Goats	Palm Trees
Ghardaïa, *ksar*	8,314	209	1,000	507	60,591
Mélika, *ksar*	2,017	32	522	381	4,032
Beni-Isguen, *ksar*	5,205	41	.....	706	26,084
Bu-Nura, *ksar*	1,010	14	.....	164	9,600
El Ateuf, *ksar*	2,346	10	.....	1	14,479
Gerrara, *ksar*	3,322	118	540	743	25,700
Berrian, *ksar*	3,040	66	3,670	1,335	25,775
Totals	25,254	490	5,732	3,837	166,261
GROUP OF METLILI					
Metlili, *ksar*	1,425	268	830	1,450	7,851
Ulad Alush (nomads)	2,210	1,815	15,615	9,417	8,183
Ulad Abdelhad (nomads)	2,160	1,814	14,499	3,421	11,065
Totals	5,795	3,897	30,944	14,288	27,099

It is easy to see how the nomadic character of the inhabitants of Metlili (sedentary inhabitants of the *ksar* and nomads

[1]The figures given have been taken from the Arab Bureau of Ghardaïa. Again thanks are due Captain Cauvet, whose courtesy and competence so many travelers have long appreciated. The *Tableau général des communes de l'Algérie au 1er janvier, 1897*, prepared at the order of J. Cambon by F. Accardo, furnishes only the figures which have to do with the human population (p. 56); we have compared them with our own figures of population; they are very much alike, or even identical. The number of inhabitants by cities, which Ch. Amat gave in 1888 (*Le M'zab et les M'zabites*, p. 226), on the contrary, differs quite considerably from ours. It goes without saying that we do not pretend to attribute absolute correctness to the figures which we have here brought together, any more than to those of the table of the Suf; in regions where the census of human beings is only approximate, the statistical evaluation of herds is even more approximative. But in regard to their relative values and their general relation to each other, they are exact enough to be noted here and consulted.

included) asserts itself: fewer than 6,000 in number, they own nearly 4,000 camels, while the 25,000 inhabitants of the seven cities possess in all only 500.

But, on the other hand, the inhabitants of Metlili have almost as many palm trees (27,000, which is an average of 5 palm trees per inhabitant) as the Mozabites of the cities (166,000, which is more than 6 palm trees per inhabitant).[1]

The Mozabites

Thus the Mozabite inhabits several houses. He cultivates with a view to his own pleasure and varies his cultivation in order to have choice products at all times of the year. He provides himself with fruits of every sort. He does not export, but, on the contrary, he imports many products, particularly meat; he even brings in from outside foods that are produced in the Mzab, but in insufficient quantities, such as dates, fruits, etc. The Mozabite is rich and lives well, and yet, strange to say, he works hard.

After all, what is this strange personage who lives a life so refined and cultivated in an environment so sterile that at first glance it seems to exclude all cultivation and all life, even though rudimentary? The Mozabite is becoming more and more an abnormal phenomenon; he can no longer be explained by the Mzab alone. The Mozabite of former times, if he was merely a cultivator, doubtless led a simpler and less expensive life; the Mozabite of to-day cannot be understood without the Tell.

The Mozabite is a cultivator in his childhood and late in life, but during middle life he is a business man. He is born and dies in the Mzab. Though he comes back at regular intervals,[2] he passes the greater part of his life far from his country; he emigrates to the Tell to earn his living and he often grows rich there.

[1] Again, it may be noted how much more Gerrara and Berrian, the two cities of Mzab which are ex-centric, as it were, being more isolated, mingle with the nomads who surround them, and show more important flocks and herds (the 3,322 inhabitants of Gerrara have 118 camels, the 3,040 inhabitants of Berrian have 3,670 sheep and 1,335 goats.)

[2] He must return to his country at least once in every two years; a woman whose husband does not return at the end of two years has the right to marry another. But these rules, which formerly were so rigorously observed and obeyed, are falling more or less into disuse.

The Mozabites are emigrants who are not moved by great appetites or great desires (like the Anglo-Saxons), since they dream of returning to pass their old age in their native country in a modest environment. They are not emigrants who are urged on by poverty in the strict sense of the word, for nothing is less poverty-stricken than the Mzab. They form a special class of emigrants who are poor only because their form of cultivation must be a rich man's cultivation, kept up at great expense; the poverty that urges them toward the Tell is relative.[1]

They are not absolutely all emigrants and they do not all become merchants; but, among the Mozabites, not to emigrate is to lose caste. In fact they are not outcasts, reduced to poverty, who go to seek their fortune in a more hospitable land. It is not as elsewhere, even in the Suf, the proletariat that furnishes the regular contingent of emigrants. Here in the Mzab it is the chosen few who set the example and maintain the tradition; or, better still, it is the former emigrants who become the élite and from whom the chiefs are chosen. The *kaids* of the Ksur are former emigrants who have grown rich as merchants.

In the Tell the Mozabite is a merchant, a small shopkeeper, notion-dealer, grocer, coal-seller, or butcher.[2] He is easily recognized in the little shops of Oran or Algiers by his round, flat face and his *gandura* with large colored stripes.[3] It is

[1]And it is this relative poverty that has saved them. What fine types of humanity are to be met with in the Mzab! One must have visited other oases of the Sahara, especially the oases peopled by blacks, to realize by contrast the value of the people of the Mzab. See the frank and vigorous book by E. Gautier, *La Conquête du Sahara, Essai de psychologie politique*, Armand Colin, Paris, 1910, especially pp. 134 ff., where he speaks of the "physical abasement" of the "sixty thousand Ethiopians" of Gerrara, of Tuat, and of Tidikelt. Farther on, E. F. Gautier writes: "The sedentary inhabitant, in the Sahara, is something like a foreign body in the organism; a black coolie attached to the soil. . . . The true Saharian, the aboriginal, is the nomad, as for instance the Tuareg" (pp. 175 ff.). On the subject of the Tuareg, consult Captain Aymard's fine volume, *Les Touareg*, Hachette, Paris, 1911—interesting, vivid, and well illustrated.

[2]One-third of the male population migrate to the Tell, where they set up prosperous shops. Each city has its favorite centers: the people of Ghardaïa go to Algiers, to Oran, and to Constantine; those of Beni-Isguen to Djelfa, Tlemcen, and Laghuat; the inhabitants of El Ateuf settle at Bu-Saâda, Aumale, and Setif; the natives of Mélika go to Batna and Boghari; only at Algiers does one meet with the natives of Bu-Nura, and the people of Gerrara and of Berrian turn especially toward Tunis. Many Mozabites make fortunes; but their hearts are all set on their own land, there they all hope to return some day" (Amat, *op. cit.*, p. 202).

[3]The Mozabite merchant of the Tell wears a many-colored *gandura;* at Mzab the rich or learned Mozabite affects one of pure white wool.

with the money that he makes elsewhere that the Mozabite is able to keep up the expensive cultivation of the Mzab.[1] It is because they are merchants that they can continue to cultivate their oases.

The Mozabites are skillful merchants who do much more business in the Mzab than might be supposed.[2] At Beni-Isguen there is a Mozabite who has a sort of retail bazaar and who, in the first part of March, 1900, ordered of one traveling agent merchandise, liquids, preserves, etc., worth $4,000 (20,000 francs) and of another hardware worth $1,000 (5,000 francs). He sends the money at once, practically paying cash. This retailer often does $200 worth of business in a day.

The Mozabite merchant comes once a year, toward September, to the Tell. He goes from Algiers to Tunis to leave all his orders at once, and many of these orders together amount to $20,000 (100,000 francs).[3]

This is not the place to discuss the history of the Mozabites, their religion,[4] their political life with its strong tendencies toward equality, their strong municipal constitution, the confederation of their seven cities,[5] their struggles of *sof* with *sof*,[6] their customs and their laws,[7] nor their language.[8] The Mozabites govern themselves and do it well. Regarded by

[1]The Mozabites have lost much through the suppression of slavery; they used to work a great many negroes.

[2]For the varieties of commerce practiced by the Mozabites, see Ch. Amat, *op. cit.*, pp. 205 ff. "The Mozabite is the banker for all the nomads of the central Sahara. He makes use of them for commercial operations, he employs them as simple commissioners or as contractors" (p. 205).

[3]The Mozabite strives by every means to earn money enough to live, and to live in the Mzab. The Mzab buys a great deal of wool. "The manufacture of native clothing and of wool rugs employs, in the Mzab, more than 6,000 working men and women, chiefly of that country" (*Le Pays du mouton*, note 1 on p. 171).

[4]They belong to the Mussulman sect of the Kharidjites (see Ch. Amat, *op. cit.*, pp. 138 ff.; see especially E. Masqueray, *Formation des cités*, etc., pp. 178 ff.)

[5]See A. Coyne and especially Masqueray.

[6]See Masqueray and Dr. Huguet.

[7]See E. Zeys.

[8]See E. Masqueray, "Comparaison du dialecte des Zenaya du Sénégal avec les vocabulaires des Chaouia et des Beni M'zab," *Archives des missions*, 1879, 3d series, Vol. V, especially the excellent works by René Basset on the Berber dialects (see Bernard and Lacroix, *Histoire de la pénétration saharienne*, p. 115), and also M. Idoux, "A propos d'une grammaire M'zabite," in *Rev. bourguignonne de l'enseignement supérieur*, IX, 1899, No. 2, which contains at the beginning a bibliography. On the etymology of the word *Zenata*, the name of one of the greatest Berber families, see Ibn Khaldoun, *Histoire des Berbères et des dynasties mussulmanes*, translation by Slane, Algiers, 1852, III, pp. 188 ff.

the Arabs as schismatics, they detest them[1] and are jealous of their own independence.[2] Some cities even retain the customs of rigorously closed ethnic and religious citadels.[3] In short, the Mzab is a type of race that has kept a religious belief intact.[4]

4. CONCLUSIONS: THE SUF AND THE MZAB

It has been our intention to emphasize the abnormal character of these facts of human geography. They are facts such as our utilitarian civilization can no longer produce or even

[1]They themselves are broader minded toward believers in religions more unlike their own. In the Mzab there are a certain number of Jews; two synagogues have been built there; the Mozabites, I am told, live on a good understanding with the Jews. Duveyrier declared in 1859: "Ghardaïa is the only city of Wad Mzab with a Jewish population reaching as high as 290 or 300 individuals" ("Coup d'œil sur le pays des Beni-M'zab," etc., *Bull. de la Soc. de géog.*, Paris, 1859, p. 325). P. Soleillet, who spent the months of February and March, 1873, in the Mzab, tells us that there were not yet any Jews, except at Ghardaïa, and "living to the number of 50 or 60 families in a separate quarter" (*L'Afrique occidentale, Algérie, M'zab, Tidikelt*, Avignon, 1877, p. 70). Ch. Amat, in 1888, counted more than 400 of them at Ghardaïa and more than 300 in Berrian and Gerrara together (p. 226).

[2]The Mozabites, who are the first to go to the French school when they are in the Tell (for there French is of great service to them), rarely send their children to the the French-Arab schools of the Mzab; they are afraid of losing their character of a closed sect. It does not enter into our plan (and we regret it) to discuss the schools of the White Fathers. On the efforts of the White Fathers and of the White Sisters at Ghardaïa and in the Mzab, and on Mgr. Toulotte, see at least Captain de l'Éprevier, "Voyage dans le Sud-Algérien, Un mois dans le Sahara," *Bull. Soc. géog.*, Algiers, 1897, pp. 401–402; see especially the very interesting bulletin which appears every two months, *Missions d'Afrique des Pères Blancs* (Paris, rue de Cassette, 27). With regard to the very subject of which we are speaking, the non-attendance of the Mozabite children at the French schools, Captain de l'Éprevier said very truly in 1897: These missionaries "teach the children whom the parents are willing to entrust to them (these are especially the Jews)" (p. 402). However, the bulletin of the White Fathers, in its 151st No., January-February, 1902, tells us of what is really a revolution in the attitude so long observed by the Mozabites toward the French school; Father Chenivesse speaks of "a hundred or more pupils, almost all Mozabites," and adds: "The Jews were the chief clientèle of our dispensary also; this year it is the distrustful Mozabites who are more numerous among the sick that are cared for" (p. 226). For the French influence we earnestly hope that these facts be confirmed and the new attitude become stronger; but these very "novelties" that surprise us confirm *a contrario* our observations.

[3]Beni-Isguen is the closed city *par excellence;* they do not allow strangers to pass the night there; after market days, at six o'clock, they make everybody leave the city, and then shut the gates for the whole night. The letter from Father Chenivesse quoted above verifies the uncompromising character of Beni-Isguen: "It is only at Beni-Isguen, the "holy city" of the Mzab, that the inhabitants receive us always with the same deliberate indifference. Even the Sisters of Charity, everywhere considered as angels to whom all doors open, are no more fortunate than we in this puritan city. In a whole day devoted to offering their services to the sick, they were enabled to care for only one" (*Missions d'Afrique des Pères Blancs*, No. 151, January-February, 1902, p. 227).

[4]The co-religionists of the Mozabites, their brothers in schism, such as the inhabitants of the island of Djerba, have similarly preserved a marked ethnical individuality. Ch. Amat, on one page of his book, has an expressive sentence which well sums up the characteristics of the Mozabites: "Combining a natural taste for building with a strong religious discipline, masons controlled by monks, they (the Mozabites) have been the colonizers of the Sahara, as their Romanized ancestors (the Berbers) had been the colonizers of the Tell" (p. 188).

tolerate. All our agricultural enterprises are founded more or less, and certainly more and more, on the income from the soil. Our capitalistic habit of thought makes us less and less able to conceive as possible an establishment which costs large and continuous effort and yet serves only for the regular maintenance of ordinary daily life. We think too much of the future (of the future more than of the present) to establish activities that will demand constant and energetic toil for such a humdrum end, and the colonization of the Sahara will have to become more profitable or it will not be carried out. On the other hand, our present economic life is based upon the idea of bringing into relation—that is, into competition—different parts of the earth; and that means, after a more or less extended period, the condemnation of those regions where the labor must be as great as the result is meager. Already the Mozabites, those daring and economical merchants who know the Tell and live in it, look upon theirs as a poor country.[1] If they still love it, if they are still attached to it and return to it, they do so as the native of Auvergne who has grown rich in Paris returns to his country to build a new house in the valley of the Cère or the Jordane. In the return of the Mozabite, as in the return of the Auvergnat, there is proof of a traditional attachment to his country, but there is also a certain pride in displaying before the eyes of his fellow-countrymen the results of a life of toil. The son of the Parisian Auvergnat, born in Paris, still loves Auvergne but has much less desire to return to it. The Mozabites as yet are all born in the Mzab, since the Mozabite emigrates without his wife (like the Auvergnat who emigrates to Spain as a baker or horse-trader, or the French Canadian who works in the mills of southern New Hampshire). However, some of them have begun to remain in the Tell and, although religion, the strongest tradition, and the proud isolation of this people in the Shebka create bonds between the Mozabite and the Mzab that will last for a very long time, we can see the beginnings of an *evolution* among these practical and intelligent men.

[1]The Kaid of Ghardaïa, a very intelligent man who made his fortune in the Tell of Oran and who, for that reason, speaks better Spanish than French, gave me some categorical statements from this point of view in the course of the long talks in Spanish which I had with him.

As a fact of human and social geography the Suf presents, from every point of view, an exceptionally remarkable case. Property does not consist of land, for in those immense extents, covered with sand and crossed by dunes, each may take the space he needs to plant a few palm trees or build his house.[1] Nor does property consist of water, for water extends beneath the sand in a relatively broad sheet, within the reach of all who have the perseverance to remove eight or ten yards of sand in order to get near enough to it to plant their trees or to dig their wells. The only thing that can be considered property is the tree, and particularly the date palm.[2] Each owns what he plants and the ownership of the tree brings with it the use of the land. On the other hand, he who has no tree has no land and can dig no wells. Having no inherent right to land and water, he acquires possession of them only if, wishing to plant trees, he digs out and clears away the space for a garden. In other words, the water and the land belong to all; it is only work that causes, limits, and fixes private appropriation of them.

Moreover, no one may plant a palm tree within a certain number of yards of other palm trees, and no one has a right to dig a well within the space upon which falls the shadow of a palm tree already planted. Furthermore, only those who own trees on the outer edge of a hollow have the right to increase their gardens and plant new trees in it, and it is for their interest to leave sufficient distance—from 22 to 32 feet (7 to 10 meters)—so that the palm trees may not interfere with each other. And since the owner of a palm tree on the edge of a garden can always by his labor increase his plantation, his palm trees command a much higher price than those surrounded by others in the midst of a garden. Thus the geographical conditions are extraordinary enough to make the tree alone the initial cause, the limit, and the end of all individual wealth.

The inhabited "islands" of the Suf and of the Mzab are

[1]It goes without saying that, on the elevated portions, at the natural level of the sands, anyone who wanted to build a house would have a right to the land which his building covered; but private ownership of land exists only where there is good reason.

[2]Even in a garden containing 10 or 15 palms, the trees belong to four or five different proprietors; so an inhabitant of the Suf possesses a tree in one garden, two or three in another, 10 or 15 in a third situated some hundreds of feet away, etc.

human establishments situated in regions which were fitted by nature to be uninhabited. In the one case the wind threatens constantly to fill up the gardens; in the other there is constant fear that the water may fail.

On arriving at Ghardaïa, one is surprised to see the picturesque white city rising in the center of barren surroundings. Only now and then are seen dark spots made by scattered groups of palm trees; here and there ruins of wells prove that formerly irrigation and therefore cultivation extended up to the walls of Ghardaïa. To visit the oasis to-day it is necessary to go two or three miles (four or five kilometers) up the valley, whither cultivation has migrated.

The whole recent history of irrigation in Ghardaïa depends upon a fact which is the most eloquent illustration of the difficulties and the ruin that may be caused by the absence of a general organization. Since 1867 the little oasis of Daiet ben Daua has been allowed to become established some miles above the oasis of Ghardaïa. This oasis is to-day in full development at the expense of Ghardaïa, for it uses and exhausts the water that once supplied the gardens below. Cultivation is becoming more and more scattered.[1]

In the Suf and the Mzab the difficulties are such that the inhabitants are seeking resources outside of the oases. These two ethnic and geographic groups live more and more from the Tell. These sedentary peoples have become nomads of a certain sort—that is, emigrants. Sedentary and masters of the art of cultivation but drawn into commerce by necessity, they are becoming more and more hybrid types, cultivators and merchants.

If the Mzab and the Suf have seemed to us worthy of a comparative study from the point of view of human geography, we have pointed out how unlike they were in cultivation and in general aspect. In the Suf the trees stand alone, with nothing at their foot—no plants, no canals, not even a ditch; the ground is flat. In the Mzab, on the contrary, the soil is worked, turned over and arranged, and at the foot of the palm

[1]The causes and the results of these facts, as well as the lesson which is to be derived from them, are set forth at length in Brunhes, *L'Irrigation, ses conditions géographiques, ses modes et son organisation dans les régions arides et désertiques de la Péninsule ibérique et de l'Afrique du Nord* (1902), and we refer the reader to it.

trees are dense thickets of different kinds of trees. Nowhere in the Sahara does the palm tree live more by itself than in the Suf; nowhere is it more intermingled with other trees than in the Mzab.

But from this group of comparative observations some common conclusion may be drawn, as follows.

The Beni-Mzab and the Soafas have been able to establish their oases in the Shebka only by introducing the most highly perfected cultivation. The geographical conditions inexorably demand perfection. An ordinary type of cultivation was impossible and men had to acquire a taste for the most methodical and persistent exertion in order to maintain themselves.

It seems that the geographical environment has had a still more profound influence upon the temperament of the Mozabite and the Soafa, while differentiating them somewhat. In the Mzab the labor to obtain water is regular and constant, and ceases only in time of flood; in the Suf the struggle against the sand is more irregular and intermittent. Likewise the Mozabite certainly works more constantly and energetically, while the Soafa is much more inclined to spells and periods of idleness.

The Mzab and the Suf are not human establishments which have value merely from the work accomplished and the *relative* amount of production and comfort obtained in spite of natural conditions. They have value because of their *absolute* perfection; they represent the best that can be imagined and realized in the way of oasis cultivation. It is as if we were to find a market garden of Long Island or of the suburbs of Detroit in a remote valley of the Rockies at an altitude of 9,000 feet (3,000 meters).

They are not outposts of humanity on the geographical periphery where human life becomes impossible, rudimentary, and, so to speak, limit-forms of human establishment such as groups of Eskimo huts. They are perfect and complete establishments which are situated in natural "islands" where life is possible but not easy, where the inhabitants are on the whole relatively numerous but where the organization of labor corresponds to much less perfection or to forms of social organization entirely different; that is, for example, to the

nomadic life of pastoral peoples living in tents and in tribes. When we speak of the Soafas and especially of the Mozabites we are not speaking of *primitive* peoples (*Naturvölker*) meeting their essential needs by elementary processes, but of advanced types of *civilized* peoples (*Kulturvölker*).

It will perhaps be allowable to compare this type of high perfection in the exploitation of natural forces under such unfavorable conditions with that skillful and successful exploitation that we find among the Finns. The Finns have succeeded in transforming a niggardly country covered with snow during seven or eight months of the year into a country which is not only self-supporting but which is developing its exportations more and more (butter, for example). Or we may compare the perfect cultivation of these desert oases with the intensive cultivation found in regions laboriously won from the sea (*polders*). Man's labor in the winning of useful land from the salt water of the lagoons represents an effort so persistent and methodical that it would be folly not to cultivate the reclaimed land intensively.

In fact, the interest in a study of these two groups of the Suf and the Mzab is in bringing out the perfection of cultivation under conditions so difficult that an ordinary, easy, and indolent cultivation would not have been able to establish itself. And this is the geographical point of view that must here take precedence of all others: *It is the unfavorable conditions themselves that determine the perfection of these human establishments.* The effort that man puts forth to exploit the land is a factor both in what he wishes to do and in the difficulties which the land imposes upon him. The more difficult and refractory the earth shows itself, the more this effort increases in energy, skill, and ingenuity. Under the direct influence and under the pressure of imperious necessities man sometimes succeeds in attaining a rare degree of perfection.

CHAPTER VII

SPECIAL STUDIES OF NATURAL UNITS

SECOND EXAMPLE:

TYPES OF "ISLANDS" OF THE HIGH MOUNTAINS: THE CENTRAL ANDES[1]

THE REGIONAL DIAGRAM, IRRIGATION, NOMADISM

1. *The regional diagram.*
2. *The canyon country.*
3. *Intermont basins.*
4. *Snow-clad mountains, and bordering valleys.*
5. *The loftiest habitations in the world.*
6. *Seasonal nomadism in Northern Chile and Argentina.*
7. *The mountain border.*
8. *The Desert of Tarapacá.*
9. *The Bolivian highland.*

1. THE REGIONAL DIAGRAM

The life zones in the Central Andes of South America are so closely compressed that in many places it is but a day's ride from snow to cane fields, from high cold pastures to low hot valleys. On the east side are heavy forests, on the west a long desert. Ignorant shepherds who understand scarcely a word of Spanish live within fifty miles of some of the principal towns. The railroad tributaries are still to a large degree the llama and the mule pack-train. Irrigation, nomadism, mining, the controls of insolation, the forest, and relief, are on every hand and the responses of human kind are clear and unmistakable. Yet even the general maps available do not express the *geographic* features of the country. To supply this need for a

[1]This chapter on the Central Andes is substituted for a chapter entitled "Le Val d'Anniviers" in the original. The material is taken from Isaiah Bowman's various books and papers but especially from: "The Andes of Southern Peru," N. Y., 1916; "Regional Population Groups of Atacama," *Bull. Amer. Geog. Soc.*, XLI, 1909, pp. 142–154 and 193–211; Results of an Expedition to the Central Andes, *Bull. Amer. Geog. Soc.*, XLVI, 1914, pp. 161–183; The Highland Dweller of Bolivia: An Anthropogeographical Interpretation, *Bull. Geog. Soc. Phil.*, VII, 1909, pp. 159–184; The Distribution of Population in Bolivia, *Bull. Geog. Soc. Phil.*, VII, 1909, pp. 74–93.

region of such great scientific interest would require much time and expense if it were undertaken through the medium of topographic surveys. What can take the place of maps in such a case? It is here proposed that the geographer should use a so-called *regional diagram*. The purpose of this chapter is to explain this new diagram in relation to seven type examples of the geography of the Central Andes.

Each diagram brings out the factors of greatest importance in the distribution of the people in a given region. Furthermore, the facts are compressed within the limits of a small rectangle. This compression, though great, respects all essential relations. For example, every location on these diagrams has a concrete illustration but the accidental relations of the field have been omitted; the essential relations are preserved. Each diagram is, therefore, a kind of generalized type map. It bears somewhat the same relation to the facts of human geography that a block diagram does to physiography.

To take an illustration: In Fig. 165 we have the Apurimac region near Pasaje, Peru (see location map, Fig. 166). At the lower edge of the rectangle is a snow-capped outlier of the Cordillera Vilcapampa. The belt of rugged country represents the lofty, steep, exposed, and largely inaccessible ridges at the mid-elevations of the mountains below the glaciated slopes at the heads of tributary valleys. The villages in the belt of pasture might well be Incahuasi and Patapampa. The floors of the large canyons on either hand are bordered by extensive alluvial fans. The river courses are sketched in a diagrammatic way only, but a map would not be different in its general disposition. Each location is justified by a real place with the same essential features and relations. In making the change from the actual to the type representation there has been no alteration of the general relations of the alluvial lands to each other or to the highland. By suppressing unnecessary details there is produced a diagram whose essentials have a simple character and clear relations. When such a regional diagram is amplified, as in this chapter, by photographs of real conditions, it becomes a sort of generalized picture of a large group of geographic facts. One could very well extend this method to the whole of South America or to any region whether

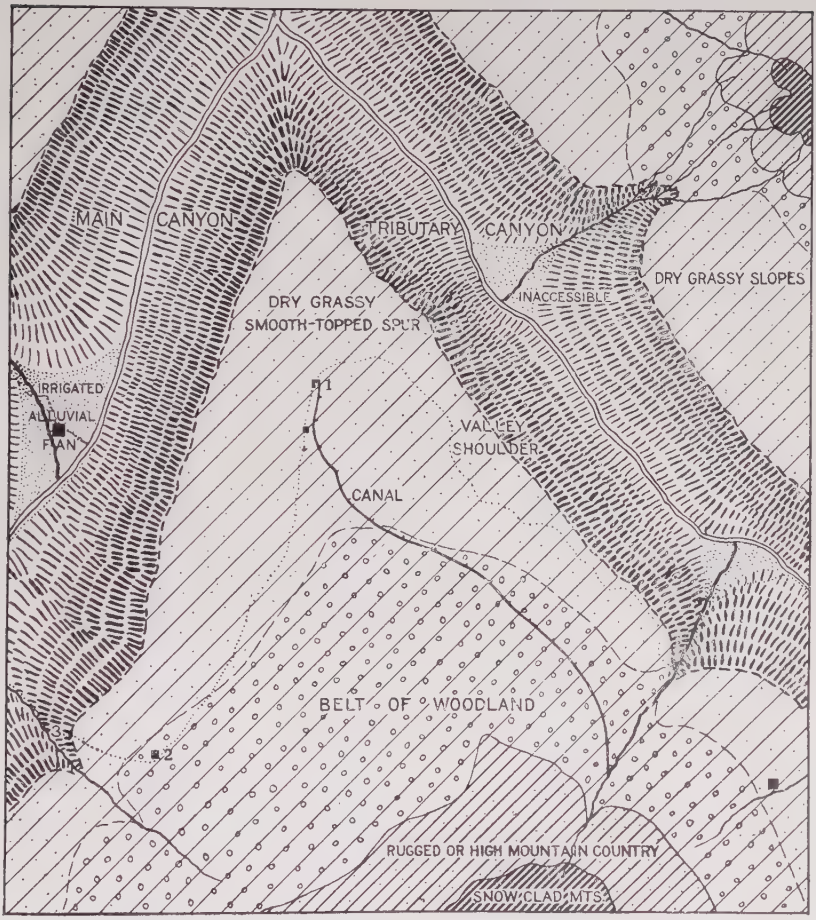


FIG. 165. REGIONAL DIAGRAM OF THE DEEP CANYON AND GRASSY UPLAND ENVIRONMENT IN THE LOFTY MOUNTAIN ZONE OF PERU

For location see Fig. 166, A; the numbers 1, 2, 3, correspond in position to the same numbers in Fig. 167.

mapped or unmapped. It would be a real service to geography to draw up a set of, say, twelve to fifteen regional diagrams, still further generalized, for the frontier regions of the world now known only through reconnaissance surveys.

The same symbols are employed on all the diagrams as follows: snow, heavy cross-lining; strong relief, close cross-lining; moderate relief, open cross lining; plains and plateaus,

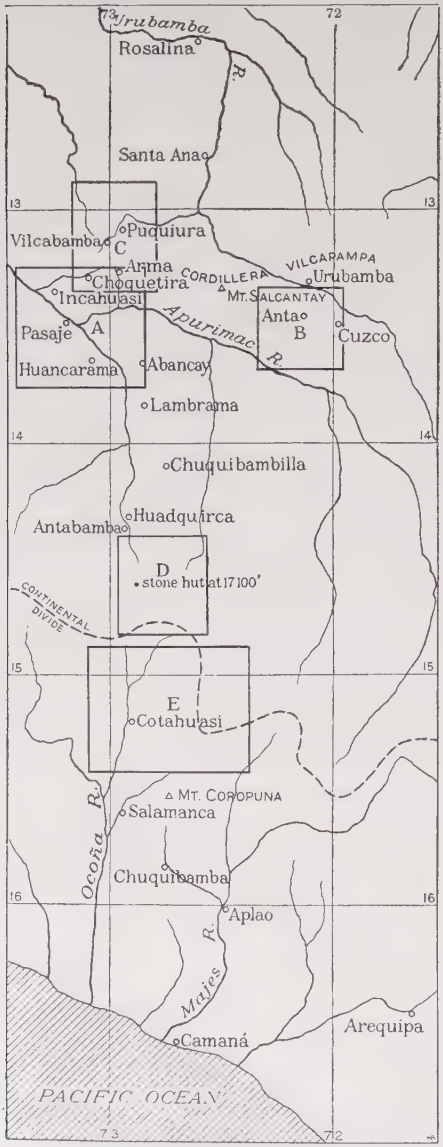


FIG. 166. LOCATION MAP OF PART OF SOUTHERN PERU SHOWING THE POSITIONS OF FIVE OF THE REGIONAL DIAGRAMS IN THIS CHAPTER

A corresponds to Fig. 165; B, to Fig. 170; C, to Fig. 173; D, to Fig. 178; and E, to Fig. 182.

no cross-lining; cliffs and canyon walls, hachures; woodland and forest, small circles; grass land, dots; fine alluvium, small dots; coarse alluvium, large dots; towns and villages, squares roughly proportional to their size; trails, dotted lines; railroads, cross-tie symbol; swamps, tuft symbol; lakes, horizontal cross-lining; etc.

2. THE CANYON COUNTRY

Returning to Fig. 165, we first note its location in Peru (Fig. 166). It represents a region unknown to scientific geography until within the past few years—the western slope of the Cordillera Vilcapampa and the deep canyon country adjacent thereto. First there is the unpopulated snow-clad region at the top of the country. Below it are grassy slopes, the homes of mountain shepherds, or rugged mountain country unsuited for grazing. Still lower there is woodland, in patches chiefly, but with a few large continuous tracts. The shady sides of the ravines and the mountains have the most moisture, hence bear the densest growths.

Finally, the high country terminates in a second belt of pasture below the woodland.

Wherever streams descend from the snow or woodland country there is water for the stock above and for irrigation on the

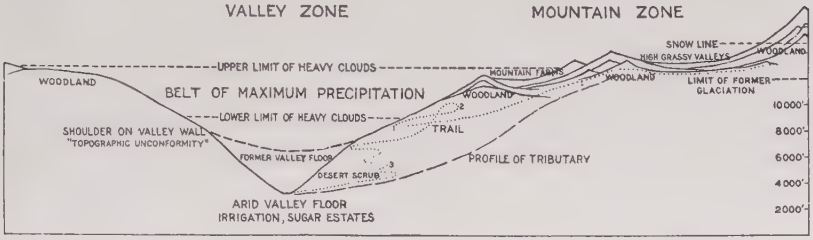


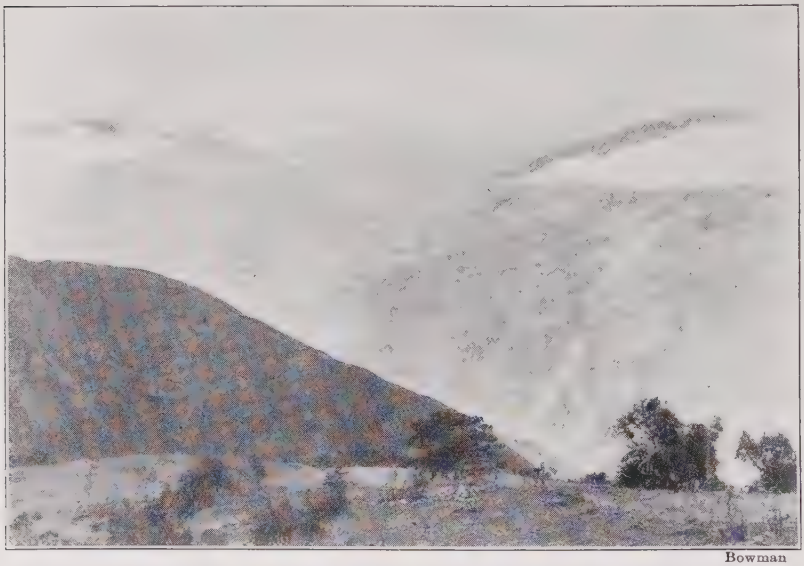
Fig. 167. Climatic and Topographic Cross-Section of the Deep Canyon and Grassy Upland Type of Environment

The numbers along the trail in this diagram correspond in position with the same numbers in Fig. 165.

alluvial fan below. But the spur ends, dropping off abruptly several thousand feet, have a limited area and no running streams, and the ground water is hundreds of feet down. There is grass for stock, but not water. In some places the stock is driven back and forth every few days. In a few places water is brought to the stock by canal from the woodland streams above, as at Incahuasi. In the same way a canal brings water to Hacienda Pasaje from a woodland strip many miles to the west. The little canal shown in the diagram, Fig. 165, is almost a toy construction, as it is only a few inches wide and deep and conveys only a trickle of water. Yet on it depends the settlement at the spur end and if it were cut the people would have immediately to repair it or establish new homes elsewhere.

The canal and the pasture are possible because the slopes are moderate. The slopes were formed in an earlier cycle of erosion when the land was lower. They are hung midway between the rough mountain slopes above and the steep canyon walls below (Figs. 167, 168). Their smooth descents and gentle profiles are in very pleasing contrast to the rugged scenery about them. The trails follow them easily. Where the slopes are flattest farmers have settled and produce good crops of corn, vegetables, and barley. Some farmers have even developed

three- and four-story farms. On an alluvial fan in the main valley they raise sugar cane and tropical and subtropical



Bowman

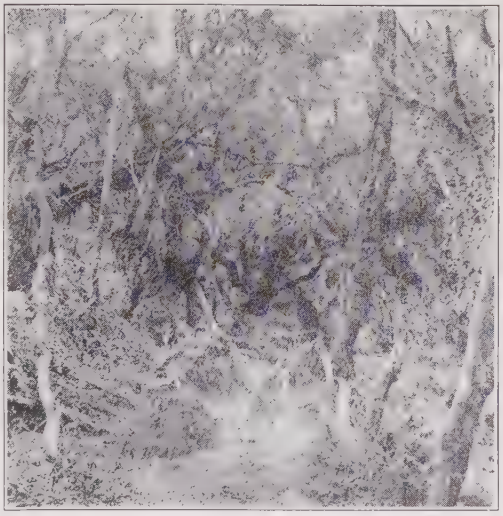
FIG. 168. THE APURIMAC CANYON NEAR PASAJE, PERU. IT IS 10,000 FEET FROM THE TOP OF THE COUNTRY IN THE BACKGROUND TO THE FLOOR OF THE CANYON. IT IS A MILE FROM THE CAMERA TO THE CANYON FLOOR. SEE FIGS. 165 AND 167

fruits; on the flat upper slopes they produce corn; in the moister soil near the edge of the woodland are fields of mountain potatoes; and the upper pastures maintain flocks of sheep. In one district this change takes place in a distance that may be covered in five hours. Generally it is at least a full and hard day's journey from one end of the series to the other.

Wherever these features are closely associated they tend to be controlled by the planter, who lives in some deep valley thereabouts. Where they are widely scattered the people are independent, small groups living in places that are nearly inaccessible. Legally they are all under the control of the owners of princely tracts that take in the whole country, but the remote groups are left almost wholly to themselves. In most cases they are supposed to sell their few commercial products to the *hacendado* who nominally owns their land, but the administration of this arrangement is left largely to

chance. The shepherds and small farmers near the plantation are more dependent upon the planter for supplies, and also their wants are more varied and numerous. Hence they pay for their better location in free labor and in produce sold at a discount.

So deep are some of the main canyons, like the Apurimac (Fig. 168) and the Cotahuasi, that their floors are arid or semi-arid. The fortunes of Pasaje are tied to a narrow canal from the moist woodland and a tiny brook from a hollow in the valley wall. Where the water has thus been brought down to the arable soil of the fans there are rich plantations and farms. Elsewhere, however, the floor is quite dry and uncultivated. In small spots here and there is a little seepage, or a few springs, or a mere thread of water that will not support a plantation, wherefore there have come into existence the valley herdsmen and shepherds. Their intimate knowledge of the moist places is their capital, quite as much as the cattle and sheep they own. In a sense their lands are the neglected crumbs from the rich man's table. So we find the shepherd from the hills invading the valleys just as the valley farmer has invaded the country of the shepherd.



Bowman

FIG. 169. TYPE OF TWISTED GROWTH FOUND IN THE BELT OF WOODLAND SHOWN IN FIG. 166

3. INTERMONT BASINS

The intermont basin type of topography, illustrated in a score of localities in Peru, Bolivia, and northwestern Argentina, calls into existence a set of relations quite distinct from

those we have just described. Fig. 170 represents the main facts. The rich and comparatively flat floor of the basin supports most of the people. The alluvial fans tributary thereto are composed on their outer margin of fine material and at their heads of coarse stony waste. Hence the valley farms also extend over the edges of the fans, while only pasture or dense chaparral occupies the upper portions. Finally there is the steep margin of the basin where the broad and moderate slopes of the highland break down suddenly to the floor of the basin. (See Fig. 171.)

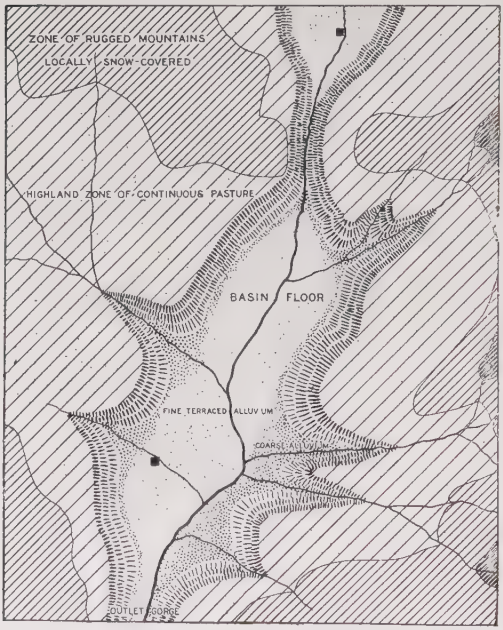


FIG. 170. REGIONAL DIAGRAM OF THE BASIN TYPE OF TOPOGRAPHY; DEEP ALLUVIAL SOIL, HIGH LEVEL PASTURES, RUGGED SNOW-CLAD MOUNTAINS, AND CONCENTRIC DRAINAGE

For location see B, Fig. 166. See also Figs. 171 and 172.

If a given basin lies at an elevation which exceeds 14,000 feet there will be no cultivation, only pasture. If it lies at 10,000 or 11,000 feet there will be grain fields below and potato fields above (see Figs. 171 and 172). If the basin lies at a still lower elevation, fruit will grow in the basin and finally sugar cane and many other subtropical products, as at Abancay.

Much will also depend upon the amount of available water and the extent of the pasture land all about. Thus the densely populated Cuzco basin has a vast mountain territory tributary to it and is itself within the limits of barley and wheat cultivation. Furthermore there are a number of smaller basins nearby, like the Anta basin on the north, which are

dependent upon the better markets and transportation facilities of the Cuzco basin.

A dominance of this kind is self-stimulating and at last is out

Bowman

FIG. 171. BORDER OF THE CUZCO BASIN TO SHOW ALLUVIAL FLOOR, STEEP MARGIN, AND EDGE OF GRASS COVERED UPLAND. SEE FIG. 170

of all proportion to the original differences of nature. Cuzco has also profited as the gateway to the great northeastern

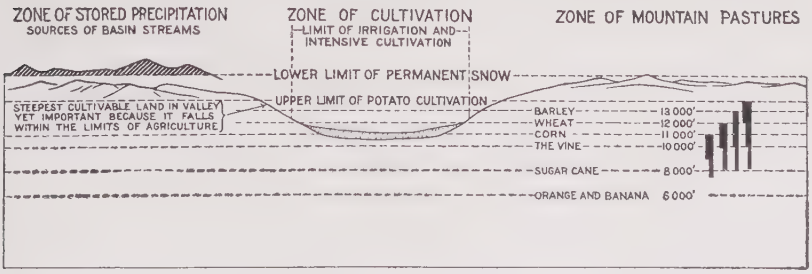

ZONE OF STORED PRECIPITATION
SOURCES OF BASIN STREAMS
ZONE OF CULTIVATION
LIMIT OF IRRIGATION AND INTENSIVE CULTIVATION
ZONE OF MOUNTAIN PASTURES
LOWER LIMIT OF PERMANENT SNOW
UPPER LIMIT OF POTATO CULTIVATION
STEEPEST CULTIVABLE LAND IN VALLEY YET IMPORTANT BECAUSE IT FALLS WITHIN THE LIMITS OF AGRICULTURE
BARLEY 13 000'
WHEAT 12 000'
CORN 11 000'
THE VINE 10 000'
SUGAR CANE 8 000'
ORANGE AND BANANA 6 000'

FIG. 172. CLIMATIC AND TOPOGRAPHIC CROSS-SECTION OF AN INTERMONT BASIN, PERUVIAN ANDES. SEE CORRESPONDING REGIONAL DIAGRAM, FIG. 170, AND PHOTOGRAPH, FIG. 171

The thickness of the dark symbol on the right is proportional to the amount of each product at the corresponding elevations.

valley region of the Urubamba and its big tributaries. All of the varied products of subtropical valleys find their immediate market at Cuzco.

The effect of this natural conspiracy of conditions has been to place the historic city of Cuzco in a position of extraordinary importance. Hundreds of years before the Spanish Conquest it was a center of far-reaching influence, the home of the powerful Inca kings. From it the strong arm of authority and conquest was extended; to it came tribute of grain, wool, and gold. If the rise of the Incas to power was not related to the topography and climate of the Cuzco basin, at least it is certain that without so broad and noble a stage the scenes would have been enacted on a far different scale. The first Inca king and the Spanish conquerors after the Incas found here no mobile nomadic tribes melting away at the first touch, nor a race of savages hiding away in the forest fastnesses, but a well-rooted agricultural race and a large city.

The full occupation of the pasture lands about the Cuzco basin is in direct relation to the physical conditions that control the food supply. Every part of the region feels the pressure of population. Nowhere else in the Peruvian Andes are the limits between cultivation and grazing more definitely drawn than here. Moreover, there is to-day a marked difference between the types that inhabit highland and basin. The basin Indian is either a debauched city dweller or, as generally, a relatively alert farmer. The shepherds, on the other hand, are exceedingly ignorant and live for the most part in a manner that is almost as primitive as at the time of the Conquest. They are shy and suspicious. Many of them prefer a life of isolation and rarely go down to the town. They live on the fringe of culture. The new elements which have come into their lives have come to them solely by accident and by what might be called a process of human seepage. The slight advances that have been made have not happened by design, they have merely happened. Put the highland shepherd in the basin and he would starve in competition with the basin type. Undoubtedly he would live in the basin if he could. He has been driven out of the basin; he is kept out.

And thus it is around the border of the Abancay basin southwest of Cuzco, and other basins like it, as for example the Cochabamba and Cliza basins in Bolivia and the Salta

basin or Valle de Lerma in Argentina, save that the Abancay basin is lower and more varied as to resources. There the Indian is in competition with the capitalistic white planter. He lives on the land by sufferance only. Great sugar estates occupy the basin floor; farther up the slopes are the farms of the Indians, and above them are the pastures of the ignorant shepherds. Whereas the Indian farmer who raises potatoes clings chiefly to the edge of the Cuzco basin where lie the most undesirable agricultural lands, the Indian farmers of Abancay live on broad rolling slopes so well cultivated and fenced, so clean and productive, that they remind one of the beautiful rolling prairies of Iowa.

4. SNOW-CLAD MOUNTAINS AND BORDERING VALLEYS

In the Vilcapampa region on the eastern border of the Andes we have a third type of distribution (Fig. 173) The Cordillera Vilcapampa is snow-crested, containing a number of fine white peaks like Salcantay, Soray, and Soiroccocha. There are a large number of small glaciers and a few that are several miles long. There was here in glacial times a much larger system of glaciers which lived long enough to work great changes in the topography. The floors of the glaciated valleys were smoothed and broadened and their gradients flattened. The side walls were steepened and precipitous cirques were formed at the valley heads. Also, there were built across the valleys a number of stony morainic ridges. With all these changes there was, however, but little effect upon the main masses of the big inter-valley spurs. They remain as before — bold, wind-swept, broken, and nearly inaccessible.

The work of the glaciers aids the mountain people. The stony moraines afford them handy sizable building material for their stone huts and their numerous corrals (Fig. 175). The thick tufts of grass in the marshy spots in the overdeepened parts of the valleys furnish them with grass for their thatched roofs. And, most important of all, the flat valley floors have the best pasture in the whole mountain region. There is plenty of water. There is seclusion, and, if a wall be built from one valley wall to another, an entire section of the valley may be inclosed, and with little labor. Thus each valley floor

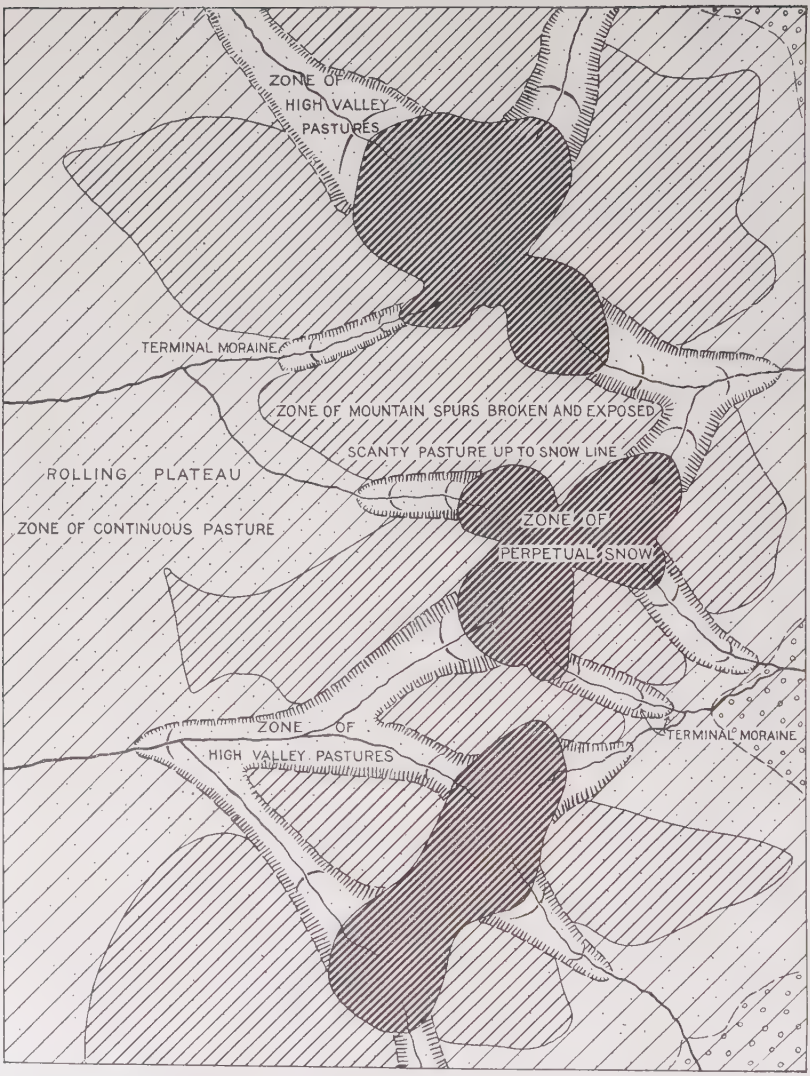


FIG. 173. REGIONAL DIAGRAM OF THE CORDILLERA VILCAPAMPA, PERU
For location see C, Fig. 166

is marked by a band of population. A village like Choquetira, located on a bench on the valley side, commands an extensive view up and down the valley — an important feature

in a village where the corrals cannot always be built near the houses of the owners. Long, finger-like belts of highland-shepherd population have thus been extended into the mountain valleys (See Fig. 173). Sheep and llamas drift right

Bowman

FIG. 174. A POTATO FIELD AT 12,000 FEET, VILCABAMBA, PERU

There is no cultivation. The seed potato is merely dropped into a hole made in the sod, and left to grow without further attention.

up to the snow line, for in some places not more than a few hours' journey separates a village from a permanent snow field.

There is, however, a marked difference between the people on opposite sides of the Cordillera Vilcapampa. On the west the mountains are bordered by a broad highland devoted to grazing. On the east there is a narrower grazing belt leading abruptly down to tropical valleys. The eastern or leeward side is also the warmer and wetter side of the Cordillera. The snow line is several hundred feet lower. The result is that

patches of scrub and even a little woodland occur almost at the snow line in favored places. Mist and storms are more

Bowman

FIG. 175. CORRALS IN THE ZONE OF PASTURE AT 15,500 FEET BETWEEN LAMBRAMA AND CHUQUIBAMBILLA, PERU

For location, see Fig. 166.

frequent. The grass is longer and fresher. Vegetation in general is more abundant. The people make less of wool than of cattle, horses, and mules. Vilcapampa pueblo is famous for its horses—wiry, long-haired little beasts, as hardy as Shetland ponies. Cattle are found grazing only five hundred feet below the limit of perpetual snow. Thus the limits of agriculture are higher on the east; likewise the limits of cattle grazing that naturally goes with agriculture. This

is especially well shown in the difference between dry Arma, deep-sunk in a glaciated valley west of the crest of the mountains, and wet Puquiura, a half day's journey east of the crest. There is no group on the east at all comparable to the shepherds of Choquetira on the west, either in the matter of thoroughgoing dependence upon grazing or in that of dependence upon glacial topography.

Though the effects of glaciation are strongly marked at high altitudes the most important effects are to be found below the limit of glaciation. The rock waste detached by the ice was swept forward by streams and deposited in the middle and lower courses of the valleys where it became the

Bowman

FIG. 176. JUNCTION OF THE YANITILI AND THE URUBAMBA RIVERS NEAR PABELLON, PERU

The grass-covered slopes extend down the dry lower valley slopes while the moister slopes at higher elevations are covered with mountain forest.

productive soil of the mountain farmer (Fig. 177). The narrow touques of pasture land on the floors of glaciated

valleys at high elevations thus have their counterpart in the narrow cultivated bands on the aggraded valley floors of lower elevations. Where the deep soils of glacial origin

H. L. Tucker

FIG. 177. ALLUVIAL FILL IN HIGH-LEVEL MOUNTAIN VALLEYS, PERUVIAN ANDES. ELEVATION, 11,000 FEET, OLLANTAYBAMBA, PERU

The fill is the result of overloading of the streams in glacial times, in turn due to intensive glacial scouring at the valley heads.

fall below the limit of severe frosts the degree of cultivation is astonishingly high. The smooth green fields stand out in strong contrast to the naked mountain walls forming the valley sides.

5. THE LOFTIEST HABITATIONS IN THE WORLD

In Fig. 178 we have one of the most extreme sets of conditions to be found anywhere and they have led to the development of the loftiest habitations in the world (Fig. 179). Between Antabamba and Cotahuasi occur the highest passes in the Maritime Cordillera. At 17,100 feet, just below one of the highest passes, is the last outpost of the Indian shepherds. The snow line, very steeply canted away from the sun, is between 17,200 and 17,600 feet. At frequent intervals during the three months of winter, snowfalls during the night and terrific hailstorms in the late afternoon drive both shepherds and flocks to the shelter of leeward slopes or steep

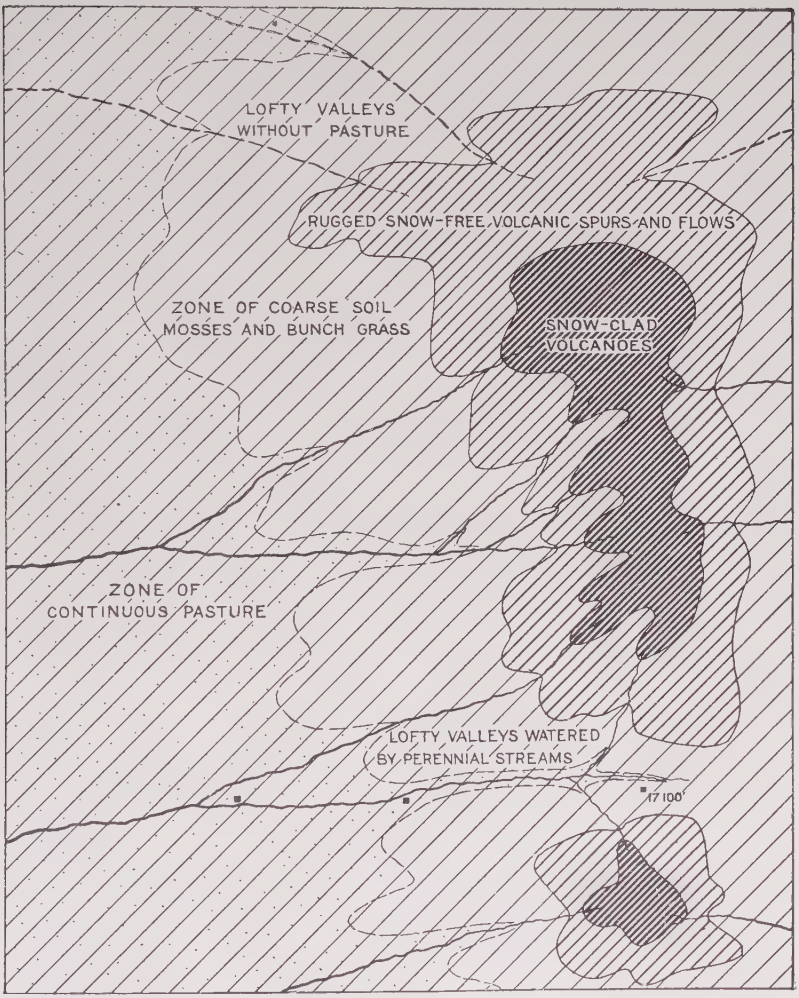
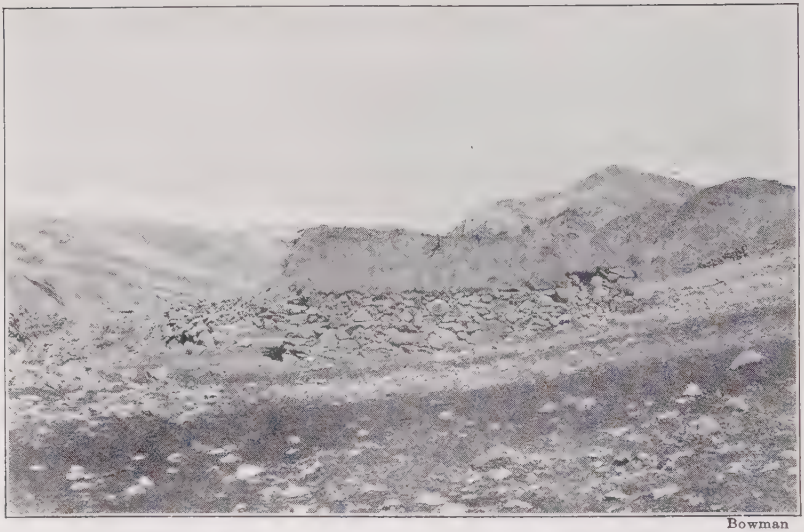


FIG. 178. REGIONAL DIAGRAM OF THE MARITIME CORDILLERA OF PERU ON THE 73d MERIDIAN

The environment in the region of the loftiest habitations in the world. For location see D, Fig. 166.

canyon walls. Here we have the limits of altitude and the limits of resources. The inter-valley spaces do not support grass. Some of them are quite bare, others are covered with mosses. It is too high an altitude for even the tola bush—

that pioneer of Alpine vegetation in the Andes. The distance[1] to Cotahuasi is 75 miles, to Antabamba 50 miles. Thence wool must be shipped by mule-back to the railroad, in the one



Bowman

FIG. 179. THE HIGHEST KNOWN HABITATION IN THE WORLD

Elevation, 17,100 feet, Maritime Cordillera of Peru. The snowline is but a few hundred feet higher.

case 250 miles to Arequipa, in the other, 200 miles to Cuzco. Even the potatoes and barley, which must be imported, come from valleys several days' journey away. The question naturally arises how these people live on the rim of the world.

The main tracts of lofty pasture above Antabamba cover mountain slopes and valley floor alike, but the moist valley floors supply the best grazing (Figs. 180 and 181). The main valleys, moreover, have been intensively glaciated. Hence their floors are broad and flat, though their sides are steep. Marshy tracts, periodically flooded, are scattered throughout, and here and there are overdeepened portions where lakes have gathered. There is a thick carpet of grass, also numerous huts and corrals, and many flocks. At the upper edge of the main zone of pasture the grasses become thin

[1]Distances are not taken from the map but from the trail.

and with increasing altitude give out altogether, except along the moist valley floors or on shoulders where there is seepage.

If the streams head in dry mountain slopes without snow the grassy bands of the valley floor terminate at moderate elevations. If the streams have their sources in snowfields or glaciers there is a more uniform runoff, and a ribbon of pasture may extend to the snow line. To the latter class belong the pastures that support these remote people.

With extensive grazing grounds at high elevations and bands of pasture along snow-fed streams in broad valleys there combines a third factor: the character of the soil. Large amounts of volcanic ash and lapilli were thrown out in the late stages of volcanic eruption in which the present cones of the Maritime Andes were formed. The coarse texture of these deposits allows the ready escape of rainwater. In their present condition they would therefore be arid in almost any climate. The combination of extreme aridity and great elevation result in a double restraint upon vegetation. Outside of the moist valley floors with their film of ground moraine on whose surface plants find a more congenial soil there is an extremely small amount of pasture. Here are the natural grazing grounds of the fleet vicuña. They occur in hundreds, and so remote and little disturbed are they that near the main pass one may count them by the score.

Bowman

FIG. 180. TEMPORARY SHELTER HUT OF GRASS-COVERED POLES USED BY MOUNTAIN SHEPHERDS IN THEIR WANDERINGS ABOVE THE ZONE OF HABITATION IN THE PERUVIAN ANDES

This hut is at an elevation of 15,500 feet

The extreme conditions of life existing on the lofty plateaus of the Central Andes are well shown by the readiness with

which even the hardy shepherds avail themselves of shelter. Wherever deep valleys bring a milder climate within reach of the pastures the latter are unpopulated for miles on either side.

Bowman

FIG. 181. HUICHIHUA, PERU, AT 12,500 FEET

Type of village found at high elevation in the zone of pasture, Peruvian Andes.

These belts of lava plateau bordering the entrenched valleys are, however, as distinctly "sustenance" spaces, to use Penck's term, as the irrigated and fertile alluvial fans in the bottom of the valley. This is well shown when the rains come and flocks of llamas and sheep are driven forth from the valleys to the best pastures. It is equally well shown by the distribution of the shepherds' homes. They are found not down on the warm canyon floor, separated by a half day's journey from the grazing, but in the entrenched tributary valleys of Fig. 182 or just within the rim of the canyon. It is not shelter from the cold but from the wind that chiefly determines their location.

They are also kept near the rim of the canyon by the pressure of the farming population from below. Every hundred

feet of descent from the arid plateau increases the water supply. Springs increase in number and size; likewise belts of seepage make their appearance. The gradients in many places diminish and flattish spurs and shoulders interrupt the generally steep descents of the canyon wall (Fig. 183). Every change of this sort has a real value to the farmer and means an enhanced price beyond the ability of the poor shepherd to pay. If you ask a wealthy *hacendado* on the valley floor, who it is that live in the huts above him, he invariably says "los Indios," with a shrug meant to convey the idea of poverty and worthlessness. Sometimes it is "los Indios pobres," or merely "los pobres." Thus there is a vertical stratification of society corresponding to the superimposed strata of climate and land.

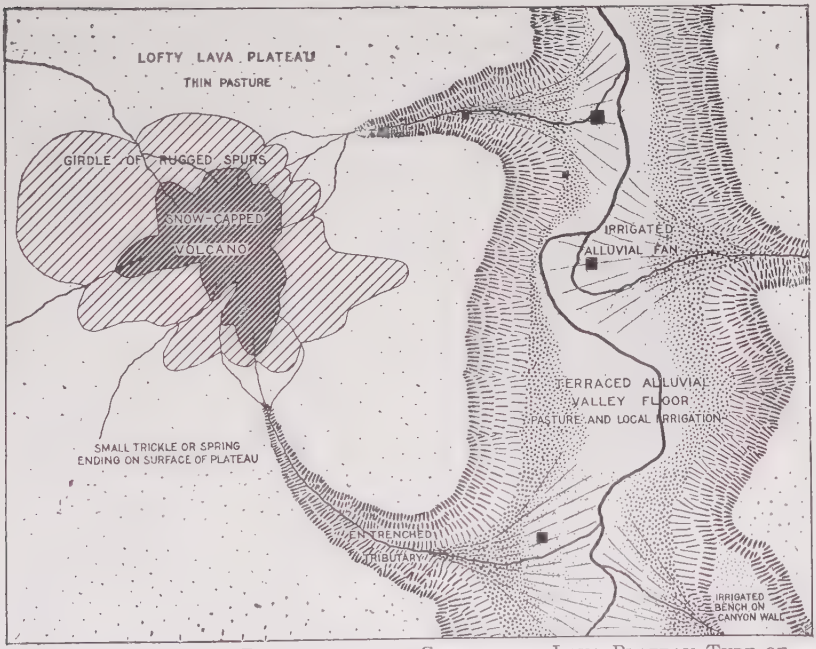

LOFTY LAVA PLATEAU
THIN PASTURE
GIRDLE OF RUGGED SPURS
SNOW-CAPPED VOLCANO
IRRIGATED ALLUVIAL FAN
TERRACED ALLUVIAL VALLEY FLOOR PASTURE AND LOCAL IRRIGATION
SMALL TRICKLE OR SPRING ENDING ON SURFACE OF PLATEAU
TRENCHED TRIBUTARY
IRRIGATED BENCH ON CANYON WALL

FIG. 182. REGIONAL DIAGRAM OF THE CANYON AND LAVA PLATEAU TYPE OF TOPOGRAPHY IN THE WESTERN CORDILLERA OF PERU ON THE 73d MERIDIAN

For location, see E, Fig. 166

From the foregoing it will be clear that there is a quite general shifting of the shepherd population of the Central Andes in response to the seasons. It will be well to remember,

however, and especially before we examine the remaining regions, that the causes and results of migration are often contradictory. These will depend on the state of civilization and

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FIG. 183. IRRIGATED TERRACES AT HUAYNACOTAS IN THE COTAHUASI CANYON AT 11,500 FEET

the extremes of circumstance. Dry years and extremely dry years may even have opposite effects. When moderate dryness prevails the results may be endurable. The oases become crowded with men and beasts just when they can ill afford to support them. The alfalfa meadows become overstocked, and cattle become lean and almost worthless. But there is at least bare subsistence. By contrast, if extreme and prolonged drought prevails, some of the people are driven forth to more favored spots. At Vallenar, in central Chile, some of the workmen in extreme years go up to the nitrate pampa; in wet years they return. When the agents of the nitrate companies hear of hard times in a desert valley they offer employment to the stricken people. It not infrequently happens that when droughts occur in Chile there are abundant rains in Argentina on the other side of the Cordillera. For this reason there has been through many generations an irregular and slight, though definite, shifting of population from one side of the

mountains to the other, as periods of drought and periods of abundant rains have alternated in the two regions.

6. SEASONAL NOMADISM IN NORTHERN CHILE AND ARGENTINA

The people of the Central Andes respond to the seasons in unlike ways. At the south (northwestern Argentina) the

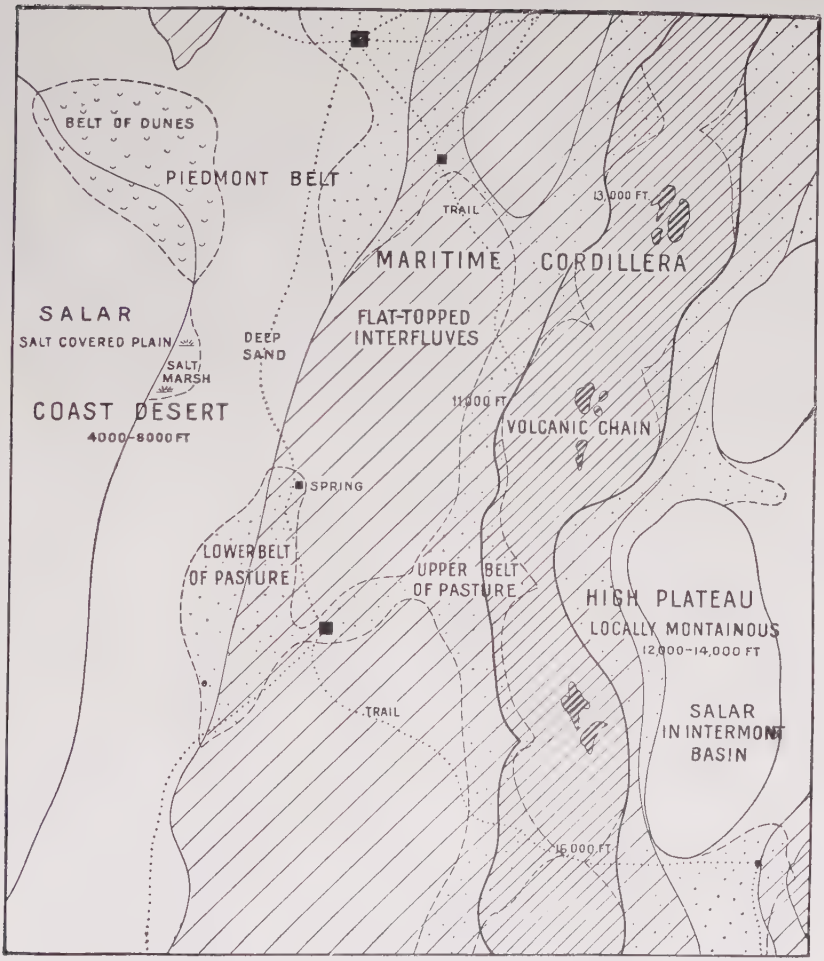

FIG. 184. REGIONAL DIAGRAM OF THE MOUNTAIN AND DESERT ZONES BETWEEN NORTHWESTERN ARGENTINA AND NORTHERN CHILE

The controlling elements of the physical environment with the exception of the direct effects of climate. For location see F, Fig. 186.

winter cold is intense and the shepherds are driven out of the upper belt of pasture, between 11,000 and 13,000 feet (Figs. 184, 185, and 186), to the warmer valleys bordering the desert in

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FIG. 185. LOOKING WESTWARD AT THE VOLCANIC CHAIN FORMING THE EDGE OF THE ANDEAN UPLIFT ON THE BORDER BETWEEN CHILE AND NORTHWESTERN ARGENTINA. OASIS OF TOCONAO IN THE LEFT MIDDLE DISTANCE

the lower belt of pasture between 8,000 and 9,000 feet. Unlike the northern part of the Central Andes the Puna de Atacama (lat. 23° to 26° S.) has a protracted period of severe winter; snow now and then blocks the passes. Instead of the fixed climatic conditions of the trade-wind belt of Peru and Bolivia we have here a zone where alternately trades and horse latitudes hold sway. The balmy days of "El Verano de San Juan" in June or the calm weather of a few weeks in summer are rare exceptions. More common are the high and bitter winds of winter. The indispensable flocks of the plateau Indian cannot be risked during the cold season in the lofty Puna and the Cordillera. Some of the shepherds make their permanent homes in the oases of the lower belt of pasture; others in the upper belt. It results that in winter the highland dweller is a nomad in the warm valleys (Fig. 187), and that in summer the valley dweller is a nomad in the high pasture country. A stone hut near a spring (Figs. 188 and 189) serves

for a shelter in both cases. The upper belt of pasture may be seen from far across the bordering desert as a band of yellow in winter and light green in summer. There are no villages in it, only an occasional group of homes or a solitary hut in some hollow of a sheltering valley wall. When the shepherd is driven from the upper *pajonales* he has little choice of places to go. The desert oasis may be crowded but there his flock must ultimately be driven. The sole though temporary alternative is to seek out the neglected spots where tiny springs water a narrow ribbon of green. There his flock wanders from one clump of shrubbery to another or gathers in greedy rings about rare hummocks of grass.

FIG. 186. LOCATION MAP OF SOUTHWESTERN BOLIVIA, NORTHWESTERN ARGENTINA, AND NORTHERN CHILE, SHOWING THE POSITIONS OF FOUR OF THE REGIONAL DIAGRAMS IN THIS CHAPTER

F, corresponds to Fig, 184; G, to Fig. 191; H, to Fig. 197; and I, to Fig. 201.

The mountain shepherds are stunted in mental development by the harsh climate and slender resources of their cold valleys and high pampas. Otherwise we might expect an armed contest for food between the oasis dweller and the migratory mountain shepherd. Actually we find that there is the closest and friendliest relation. The causes for this condition lie not only in the mentality of the Indian; they lie also

in the geographic distribution of his principal natural resources. The oases on the western border of the Cordillera are for the most part mere dots in a vast desert. Miles of almost naked

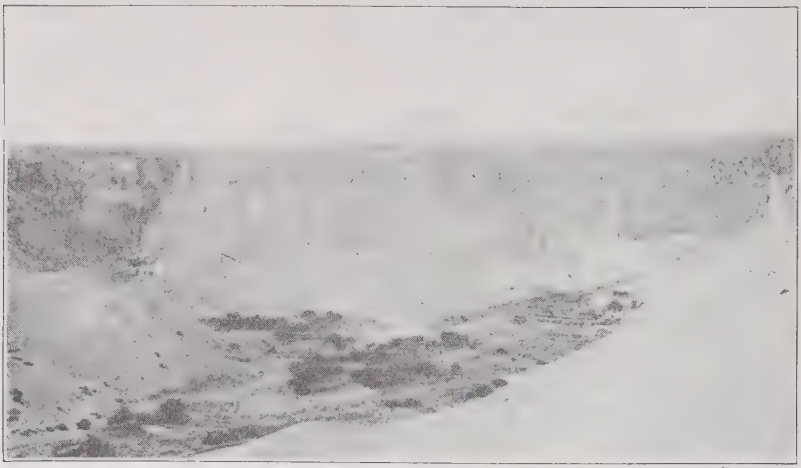

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FIG. 187. OASES OF SONCOR, DESERT OF ATACAMA, NORTHWESTERN ARGENTINA. ELEVATION 8,500 FEET. VOLCANIC CHAIN OF FIG. 185 IN BACKGROUND

lava separate them from the belt of mountain pastures. Miles of hot sandy piedmont separate them from each other. In the absolute desert about them their own flocks, had they any, would find subsistence for only a part of the year. Hence the small size and scattered distribution of the oases make them quite as dependent on the flocks of the shepherds as the shepherds are dependent upon the vegetable food of the oases. Indeed, this supplementary relation is carried so far in the case of the smaller oases that they are merely the winter camps for the mountain shepherds who have their own gardens which they leave to the care of the old and infirm during the greater part of the year. At Tilamonte a few patches of land are planted, then left to the care of wind and sun until the harvest is due. Above Toconao the villagers go up each year to a line of tiny springs to cultivate a few additional acres. Almost all the inhabitants of Soncor and Socaire are in the mountains in summer, leaving the windows and doors of most of the homes barred, and the gardens cared for by the feeble who are left behind.

Each village in the piedmont zone represents some natural advantage. Here a group of algarobo trees feeds on the ground water and supplies an abundance of algaroba fruit. There a clump of chañar trees supplies nuts for the delectable chañar meal. On the edge of the swamp of Tevinguiche is pasture to be rented to the cattle drivers from across the Sierra. The soil is sandy at Cucuter but it also has no harmful salts and if watered but twice a year yields good crops. At Catarpe are warm terraces easy to irrigate, hence beautiful fruit orchards.

From their valley homes in the upper belt of pastures the shepherds come to the lower oases for the supplies of chuña, chañar, dried fruit, wheat, and flour. Their dependence on the town of San Pedro, for example, is so great that in many cases they construct two huts, one at the home oasis in a quebrada miles away; another in the desert on the border of the gardens that surround the city (Fig. 190). They pasture their flocks on grasses and shrubs nearby, rest a few days, trade, and return. A few have even gone so far as to construct

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FIG. 188. TEMPORARY HOME OF MOUNTAIN SHEPHERDS ON THE EDGE OF THE DESERT OF ATACAMA, DRIVEN OUT OF THEIR MOUNTAIN HOMES BY THE WINTER COLD

a third hut on some neglected patch of land at the common border of desert and irrigated land and there plant a few grains and seeds to help out their slender resources.

Among the oasis products are a few of which they have grown very fond—chañar, for example. In very dry seasons the crop may be small and the owners unwilling to part

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FIG. 189. TEMPORARY STONE SHELTER OF MOUNTAIN SHEPHERDS AT AN ALTITUDE OF 14,000 FEET IN THE PUNA OF ATACAMA, NORTHWESTERN ARGENTINA

with it. Then the nomads refuse to sell their ropes of twisted llama wool. Now the arrieros of the town must have these to hobble their beasts at night while on a journey across the desert. Leather thongs would chafe the legs of the mules and start troublesome sores. Moreover, they cannot be so securely tied and the security of one's beasts is a most important care in desert travel. If the shepherd will not sell his valuable llama wool ropes for money the arriero must exchange for them something of less value to him. Thus he reluctantly parts with his crop of chañar nuts, for which he may substitute wheat, rather than do without the wool ropes for which he has no substitute.

In the communal vicuña hunts, now of great antiquity, these pastoral nomads on the western flanks of the Andean Cordillera show most clearly their isolated condition. Elsewhere the ancient customs have largely disappeared. The priest has substituted the ceremonies of the Christian church

for the old feasts of the harvest and the chase. But the poor shepherds of the desolate country on the mountain border of Atacama still retain their old ways. Some of them are in pure form; even those that have become modified still have a strong flavor of the original paganism. Among them the vicuña hunt is by far the most interesting.

Late in February or early in March, four or five days after the carnival of Chaya, the men of Aguas Blancas and Toconao go into the mountain country in search of vicuña. On the fifteenth day after the carnival the villages are almost depopulated. The women are busy stringing threads across the valleys down which the animals are to be driven, for the vicuña will not pass a thread or rope stretched across his path. The men scatter widely to keep the quarry in the ravines. The hunters are mounted and when the vicuña become confused and huddled they are easily shot. He who kills a vicuña gets the skin, the most valuable part. There is thus a

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FIG. 190. TEMPORARY SHELTER HUT USED BY THE MOUNTAIN SHEPHERDS WHEN VISITING THE OASES OF THE PLAIN, DESERT OF ATACAMA, NEAR SAN PEDRO DE ATACAMA

See Fig. 184

strong incentive to compete in achieving the hardest part of the hunt. The rest of the animal is common property; since the hunt is coöperative all share in some way in the spoils.

THE MOUNTAIN BORDER

The Salta region, Fig. 191, illustrates a type of geography quite distinct from any of those we have so far examined. It is characterized by a basin topography and a climate dry enough to require irrigation for the best growth of crops, though corn and grasses will grow fairly well without irrigation. On the eastern slopes of the Andes that here break down to the western edge of the basin floor the winds must rise and in consequence there is a zone of maximum precipitation on the mountains marked by a belt of temperate forest between 4,500 and 6,000 feet (Fig. 192).

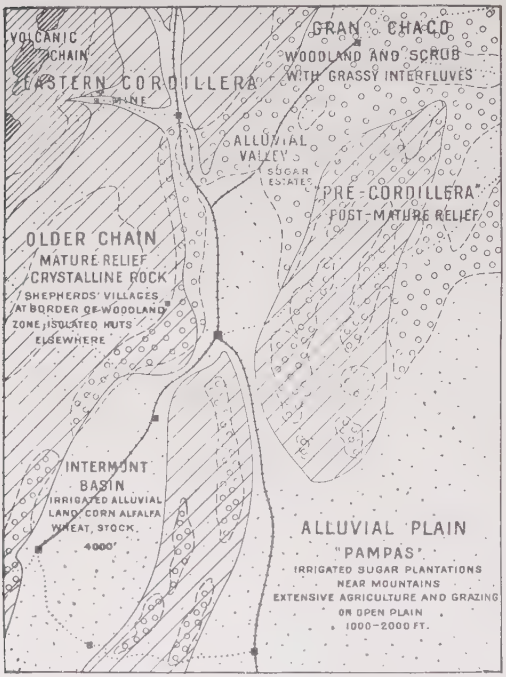

FIG. 191. REGIONAL DIAGRAM OF THE BORDER ZONE BETWEEN MOUNTAINS AND PLAINS IN NORTHWESTERN ARGENTINA

For location see G, Fig. 186.

Above the forest, scattered groves occur in favorable places and belts of timber extend up the shadier and moister valley floors. The higher country, where the scattered groves of forest cease, bears a thin cover of herbaceous vegetation which gradually changes to the scattered clumps of *ichu* grass at the highest elevations. Up to 9,000 feet barley is grown (Fig. 193); above that elevation potatoes are the chief vegetable product. The grasslands are the seat of pastoral population groups. In the forest, agriculture and grazing are combined. Below the forest a more intensive agriculture is practiced with irrigation. Those streams that have their chief tributaries in the forest

belt are most constant in flow and furnish to the population groups on the mountain border the means for agriculture and stock raising on a large scale.

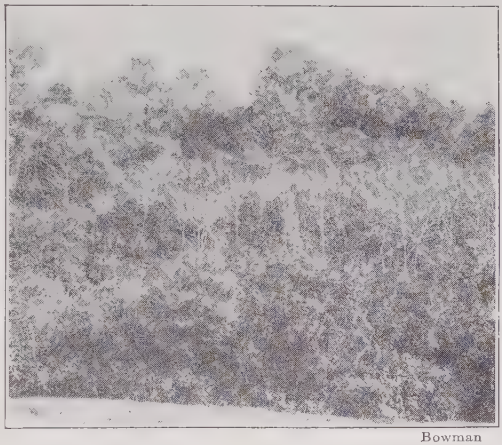

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FIG. 192. THE BELT OF WOODLAND BETWEEN 4,500 AND 6,000 FEET ON THE MOUNTAIN FLANKS WEST OF SALTA, NORTHWESTERN ARGENTINA

The variety of life on the eastern flanks of the Cordillera, due to the varied climate and resources, is exhibited in a comparatively narrow zone owing to the abrupt nature of the mountain border (Fig. 194). In a few days one may ride from the warm valleys at 4,000 feet to the bleak passes in the bordering ranges at 16,000 feet, crossing successively the belt of irrigation, the belt of forest and woodland, the belt of grasses, and the belt of barren mountain slopes and rock slides. It is but natural that there should be an intimate degree of intercourse between the people of these unlike regions. The wool and skins of the mountain shepherds (Fig. 195) are carried down by pack train (Fig. 196) to the railroad at Rosario de Lerma (thirty miles southwest of Salta); in the belt of forest, besides the growing of vegetables ("habas," beans, potatoes, etc.) wood cutting is a regular

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FIG. 193. UPPER LIMIT OF FARMS, ANDES OF NORTHWESTERN ARGENTINA, BETWEEN 8,000 AND 9,000 FEET

occupation for a limited number, to supply timber and fuel to the mines and firewood and building material to the towns. The irrigated valley lands support herds of cattle and droves of mules for the transmontane trade with the nitrate country in the Desert of Atacama. So large and profitable is the trade since the fuller development of the nitrate industry that land values have risen enormously. Many families, once poor landowners, are now rich city dwellers. This is a phenomenon now common to the eastern agricultural provinces of Argentina but it is of recent development in the mountain provinces and in some cases is due to quite different stimuli: the railroad, the growing nitrate industry in Chile, the more rapid development of mining since the introduction of the railroad, and a host of minor causes.

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FIG. 194. TYPICAL RELATION OF IRRIGATED ALLUVIAL FAN TO SNOW-CLAD MOUNTAIN ON THE EDGE OF THE ANDES, NORTHWESTERN ARGENTINA. ELEVATION, 10,000 FEET

Bowman

FIG. 195. STONE HUT AT 9,000 FEET IN THE BELT OF PASTURE, ANDES OF NORTHWESTERN ARGENTINA

No less clear than the controls of the present are those of the past. Throughout its history Salta has been an entrepôt between the mining regions of the highland rising to the west and north of it and the grass-covered plains lying toward the southeast. It is the focus of the cattle trails of a vast region and, before the

railroad was constructed, was the last town of importance on the westward trail from northern Argentina to the Pacific

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FIG. 196. PACK TRAIN CARRYING GOAT SKINS DOWN FROM THE HIGH PASTURES OF THE ANDEAN VALLEYS OF NORTHWESTERN ARGENTINA TO THE RAILROAD TERMINUS AT ROSARIO DE LERMA, WEST OF SALTA

coast at Cobija, Chile. Its annual fairs attracted thousands of traders.[1]

THE DESERT OF TARAPACÁ

For 500 miles along the west coast of South America or from Copiapó to Pisagua, the Loa is the only river of any consequence that reaches the sea and it accomplishes this only in years of heavy snowfall in the mountains. In general the mountain streams dwindle and fail on the inner side of the desert where their waters are absorbed by the deep porous sands and gravels that form a piedmont slope 350 miles long. The northern part of this region is known as the Desert of Tarapacá. Its conditions are summarized in Figs. 197 and 198.

Each failing stream—Aroma, Tarapacá, Huasquiña, Mamiña, Quisma, Huataconda, Chacarilla, and others—is the locus of a village or line of villages. Each stream is deeply incised below the level of the broad slope that directs it westward to

[1] G. M. Wrigley, "Salta, an Early Commercial Center of Argentina," *The Geographical Review*, Vol. II, 1916, pp. 116–133.

the inner eastern edge of the desert. Thus there are two chief classes of routes of travel: east-west routes along the axis of the incised streams; and a north-south route at the inner edge of the piedmont where the streams terminate. The trails are for this reason arranged in a roughly quadrilateral fashion.

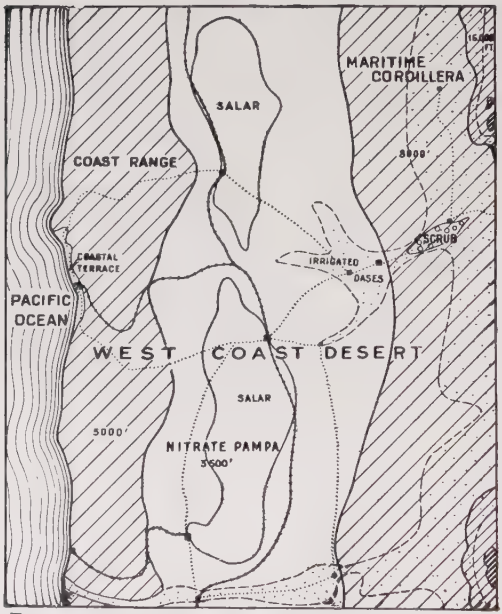

FIG. 197. REGIONAL DIAGRAM OF THE PHYSICAL ENVIRONMENT IN THE NITRATE DESERT OF TARAPACÁ, NORTHERN CHILE
For location see H, Fig. 186

So far as these interior villages at the stream endings were concerned, as well might the coast be a thousand as a hundred miles away before the development of nitrate brought railroads and ocean ports. The streams wither far from the sea, and naked desert (Fig. 199) and an uninhabited coast repel all occupation or movement in that direction. The fortunate places were in the mountains and on the inner edge of the desert, away from the sea. And there they are to-day for any population unit which must subsist upon what it produces from the soil. Before nitrate and copper were produced and the modern artificial coast towns — Iquique, Pisagua, Tocopilla, Caleta Buena — came into existence, the coast ranges and the well-nigh impassable desert intervening between them and the Andes might have been a great continental desert interior. The people looked to the mountains for their subsistence, not to the sea. It was of far more importance then that the winter's snows, whose amount they marked with great concern, should be unfailing, than that the vessels of distant ports and countries should ride at anchor off their repelling and distant shores.

The oases, separated by wide stretches of utterly barren rock and sand, were like oceanic islands in the degree of isolation they possessed. In them no single movement of any consequence was ever originated. Economically they are the least important units in Chile. Their chief consequence to the world of progressive men has been their service to land travelers who have utilized them as links in the chain of communication from central Chile to southern Peru, and from the mountainous hinterland to the coast. For example, they were determining forces in the extension of the Inca Empire. They furnished food and water and men to the imperial armies

Bowman

FIG. 198. OASES OF MATILLA, DESERT OF TARAPACÁ, NORTHERN CHILE. LOOKING WESTWARD ACROSS THE DESERT. THE TOWER TO THE LEFT OF THE PALM TREE CONTAINS A LIGHT TO GUIDE DESERT TRAVELERS AT NIGHT

and constituted bases of operations in the progressive conquest of the southerly lands. They were population units incapable of any initiative and only passively and, in a certain sense,

unconsciously serviceable to movements initiated in less hospitable regions near by. Almagro's army would have perished to a man, as, without ships and with an uncharted ocean of

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FIG. 199. SURFACE OF SALAR, IN THE DESERT OF TARAPACÁ, NORTHERN CHILE

sand and salt before them, they made their precarious way northward from central Chile, had it not been for the occasional oases scattered along their line of march. The prospectors of a later day and the traveler of the present use them to similar purpose.

No vegetation can be found from 2,000 feet to 8,000 feet in these portions of the deserts of Atacama and Tarapacá, except where the mountain streams debouch upon the piedmont slope. It is a thoroughly plantless region; not even that almost universal sign of the desert, the cactus, can be found; downright nakedness prevails. This complete barrenness of the desert pampa, outside the borders of the oases, at once denies even a pastoral occupation over the wide expanses of the region. Flocks are kept in certain numbers but they must forage on the cultivated plants of the garden farms: alfalfa, millet, etc. Not even the temporary range noted at Payta and Copiapo, and due to an occasional shower, exists here. Beyond the oases there is nothing, except in the mountains above 8,000 feet, and access to these exceedingly thin mountain pastures is denied over much of the year by the extreme

scarcity of springs and streams that may be relied upon for drinking water. Only during a few months of the spring can certain restricted areas of mountain pasture be relied upon. Of other pasturage there is none except in some underdeveloped oases where poorly watered marginal tracts, rarely more than a few square miles in extent, support a wild growth of temporary grasses and perennial shrubs which, for a short time, bear certain quantities of succulent foliage.

The population, by reason of its aloofness from the ocean and the lack of herbage afield, is sedentary to a degree. It consists of farmers deeply rooted to that portion of the soil watered by the mountain streams. Each agricultural or horticultural

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FIG. 200. PISAGUA, CHILE. A NITRATE PORT BUILT ON A NARROW TERRACE AT THE FOOT OF BLUFFS 2,000 FEET HIGH

See Fig. 197

area is to a high degree a self-centered unit. Formerly this quality was much more evident than now. To-day the great industrial development which the exploitation of the

nitrate has brought about has stirred the oases dwellers out of their lethargy. Fruit is required at Iquique, and Pica and Matilla supply a part of it, and thereby acquire a taste for the products of the town. Laborers are in high demand all through the nitrate region and the populations of the oases, crowded from the standpoint of water supply and the food resources, are often drawn upon for the service of nitrate *oficinas* or establishments.

As a consequence of the wide spaces to be overcome with perishable or bulky goods, or even any goods at all, the prices for staple commodities vary greatly from place to place. Where there is none to spare sometimes money cannot buy forage even of the worst kind; where there is plenty, it is very cheap; where there is a surplus it is given away; and where there are no inhabitants it belongs to the first comer. It is the ratio of supply to demand at a given restricted and isolated locality that determines the price, not the ratio of the aggregate supply to the demand of the whole geographic province. In short, there are no railroads and only the most primitive means of carriage for freight and passengers; and no specialized production or adequate equalization of surplus products of any kind. Furthermore, these primitive means of communication mean great expense. The prices for food, fruit, forage, and the like are as high in many places as in New York City. The price depends on the locality, the extent to which the commodity is locally produced, and the degree of abundance of the crop for a particular year.

The precarious situation of most of the towns is one of their striking characteristics. The least accident may betray them. This is well illustrated by the history of a line of settlements in the Chacarilla Valley. It was at one time a fertile and frequently visited district. But in the early 70's, as nearly as can be determined, a great flood came down the gorge, broke down the irrigating ditches, cut up the terraces or deposited infertile sand, gravel, and even boulders upon them, overwhelmed orchards, and so generally devastated the farms and discouraged the inhabitants that all but a remnant of them moved away. Their irrigation works may still be seen at the site of the now deserted village of Algarrobal.

Here and there a neglected orchard tree or pepper bush, struggling along as best it can without irrigation, or the crumbling mud walls of an abandoned home, are mournful testimony to the ruin wrought by the flood in this once happy valley.

The fragment of people now living within sight of the former more populous valley occupies a safer position. The tiny oasis of Chacarilla is perched high above reach of flood upon the slopes of a terraced alluvial fan, whose outer edge is protected by a stone wall. The small spring-fed stream discharging across the fan is led out upon the gardens and orchards by half a hundred diverting canals.

Each town of the piedmont belt has its patron saint, appropriate to the specialty for which the town is known or the condition under which it exists. St. Andrew, the patron saint of wine, is the patron saint of Pica, where excellent wine is produced; San Isidro, the patron saint of farmers, is the patron saint of Canchones, where, without a surface stream, the farmers still persist in agriculture by digging canals and great holes to the ground water, and in these they plant their grain and vegetables. Frequently the saint of one village is taken on a journey to a neighboring village. Thus, at the time of our visit to the village of Pica the Virgin of Candelaria was brought from Macaya, a copper-producing village of 600 inhabitants, lying 60 miles northeast of Pica. She came asking for alms, for it had proved a hard year at Macaya and an appeal was thus made to the generosity of the inhabitants of Pica. The patron saint of Pica was carried out to meet the visiting saint and with fife and drum the united procession returned to the village, parading the streets to the church of St. Andrew.

THE BOLIVIAN HIGHLAND

That portion of the Central Andes shown in the figure is not a line or lines of peaks or of north-south ranges, but a group of lofty, upwarped plateaus with a broad basin between. The plateaus have well-defined and fairly straight borders nicked by streams that descend from the uplands. The floor of the basin is marked by swamps and salars that indicate

the ultimate discharge from Lake Poopó, a salt lake which in turn receives the excess of Lake Titicaca by way of the Desaguadero (The Outlet) River. On the basin borders are alluvial fans and a fringe of piedmont waste.

This interior basin (Figs. 201 and 202) constitutes a part of the "alti-plano" or "planicie" (high plain or plateau) of Bolivia. In whatever direction one travels from this central basin one is required first to ascend these scarps to reach the plateaus which form the main part of the eastern and western Cordilleras with their volcanoes on the west and residuals on the east. Although the floor of the interior basin is remarkably flat over great areas, there are, in the aggregate, numerous interruptions of its surface both from volcanic accumulations

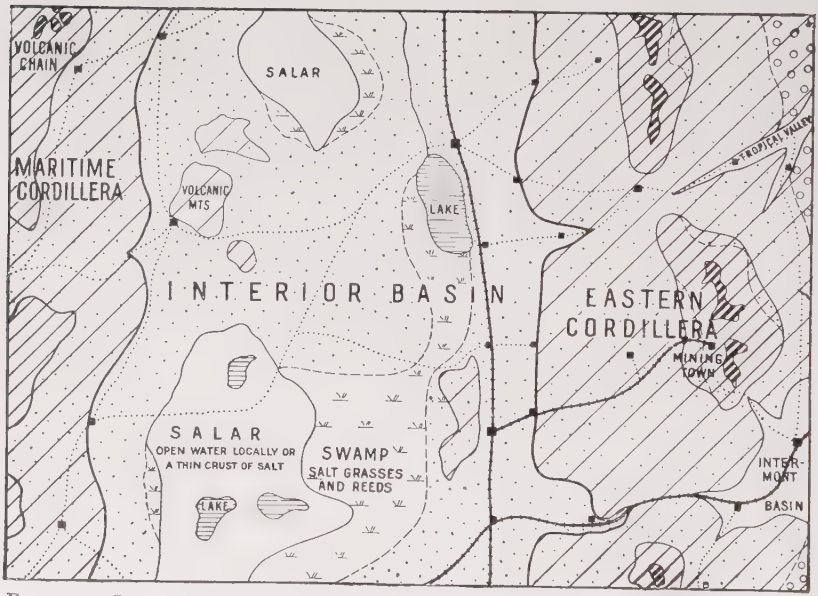

Fig. 201. Regional Diagram of the Great Titicaca-Poopó Depression or Interior Basin of Western Bolivia

For location see I, Fig. 186.

irregularly disposed and from structural irregularities which bring important projections of the adjacent plateaus within the general outlines of the basin. Finally, it may be noted that part of the regularity of the central basin is due to the

aggradation by tributary streams whereby a smooth floor of waste has concealed some of the minor irregularities once existing.

In the manner in which the plateau and mountain Indian occupies the land there is offered a strong contrast to the

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FIG. 202. SURFACE OF THE "ALTI-PLANO" OF BOLIVIA LOOKING EASTWARD AT THE CREST OF THE CORDILLERA REAL. PART OF THE INTERIOR BASIN OF BOLIVIA. ELEVATION 12,500 FEET. SEE FIG. 201

condition in the desert of Tarapacá in northern Chile. There it has been shown that the extreme degree of rainlessness precludes pastoral activities. No nomad herds may there wander about and hope to find even a meager supply of food. Cattle and sheep are maintained only at the irrigated oases and the population is strictly sedentary. To travel or to barter means first to conquer sheer waste space which will not even support the pack animals that carry the goods. The isolation of separate groups of oases dwellers is therefore very strongly marked.

The plateau and mountain-dwelling Indian is more fortunate in this respect. He lives in the very highland which acts as a barrier to the rain-laden winds and not in the desert to leeward of the barrier. His land is likewise arid, even desert, but its aridity is less intense. Thunderstorm rains are common at the change of the seasons, as when spring begins; and his farm is nearer the source of the streams—the winter snows—

than is the farm of the oasis dweller of Tarapacá. He may therefore irrigate his already naturally better watered land more bountifully. His most important advantage, however, lies in the pasturage which the inter-oases tracts afford. The light showers are sufficient to maintain some sparse and scattered vegetation. Bunch grass occurs here and there and the young edible shoots of tola bushes, cacti, etc., are also available. In addition lichens and mosses of several edible varieties form a food resource for stock of no inconsiderable amount; and these grow right up to the snow line. Of course the scattered tufts of grasses and the individual spears of grass that spring up after a shower and tinge the hillsides green are the chief forage resource.

In consequence of the widespread pasturage, flocks of llamas may be grazed upon well-nigh every agriculturally unoccupied tract that exists outside the salars and snow fields. To be sure, thousands of square miles in Bolivia, and on the mountainous frontier between Bolivia and Chile, are undergrazed or wholly vacant, but overgrazing is a fact near the centers of densest population; land and grazing rights are there a matter of livelier concern. Likewise, the tracts between closely adjacent springs are well grazed as a rule, but there are no artificial devices even of the simplest sort for procuring water for flocks where pasturage but not drinking water occurs naturally; and that grazing as an industry is on the whole underdeveloped in consequence is apparent even to the casual observer. Nevertheless, to one who has come directly from the coast desert to the Andean plateau and the mountains, the significant facts appear to be, not the underdevelopment of the grazing resource, but the widespread occurrence and use of these mountain pastures as compared with their absence in the coast desert and their distributional effect upon the inhabitants. Instead of the wholly sedentary population groups of the rainless coast desert, there are here partially fixed groups whose time is divided between agriculture and grazing, while a distinct though small number of population units are wholly dependent upon grazing. These latter live in isolated sections among the mountains in huts of roughest construction and range widely with their

flocks now in this direction, now in that, often spending several nights in succession in bleak corrals arranged at wide intervals on the border of the settled tracts.

As a rule, therefore, the mountain and plateau Indians are fundamentally agricultural as well as pastoral. The irrigated oases are relieved of the burden of animal subsistence but grazing is not generally the sole or even the chief occupation. Further reasons for this are noteworthy. In the first place the products of the flocks, wool and meat, while indispensable, are also insufficient in themselves. Vegetable foods, grains, and the like, the products of the farms and gardens, are demanded.

The farm is located near the water supply and is supplemented by the wide range behind it; either farm or range alone would be insufficient for the desired degree of comfort or prosperity. The second reason for the dominance of agriculture lies in the greater variety of foods it offers and the comparatively greater security and comfort the farmer enjoys in extracting a living. Finally, it may be said that farming and grazing may be combined where agriculture is the chief resource, while on the other hand it is not easily possible for a nomadic people, living chiefly from the products of the flock, to farm. The necessities of their flocks require constant movement and crops are without that protection from other wandering flocks and shepherds which the home near by affords. Such agricultural foods as are consumed must be purchased from the farmers of the oases.

In consequence of these sources of food supply the population groups of the mountains and plateaus of Bolivia are widely scattered as to occupation and compact as to dwelling. The highland man is a nomadic traveler to the degree that flocks are a supplemental resource to his farm. He scans the whole countryside for good pasturage, drives his flock for days through little known lofty valleys, and only returns when his supply of food becomes exhausted or there is herbage once more upon the overgrazed range near his habitation. He is a great traveler in consequence, and knows the mountain ways intimately. It is a constant marvel to one in the mountains to see to what altitudes the shepherd climbs and what

out-of-the-way places he reaches. He is the characteristic element in the Andean scene — bleak slopes in some high valley, a widely scattered flock of llamas, a solitary shepherd whistling and clucking to his vagrant flock and industriously spinning the llama wool into yarn as he trots along, often without food save the leaves of the coca, and without water for a day or more at a time, far from any shelter, alone. He is an excellent guide, fearless and confident, with knowledge of every spring and trail and no special concern for ordinary altitudes below the snow line.

One of the best indications of the firm grasp the agricultural inhabitant has upon the country is the completeness with which the alluvial fans are occupied. Illustrations may be found all the way from the southern frontier of Bolivia to northern Peru. It is the most conspicuous and general distribution fact of the whole region. Fig. 203 shows this relation of alluvial fan and town. The site is excellent not only because of the deep, rich alluvium washed from the adjacent uplands but also for the water supply which the fan itself indicates, and for the regular grades that make irrigation works easy of construction.

This kind of distribution is well represented in the highland east of Oruro. Above 14,000 feet only a most desolate landscape appears, with low scattered bushes and bleak wind-swept highlands. Then come valleys where, at about 12,000 feet and in the well-watered patches, barley fields of some consequence appear. At one spot we observed a shaded spring, frozen solid, and just above it on a sunny slope a patch of growing barley. A greater abundance of natural vegetation is noted here, with a corresponding increase in the number and size of the flocks of llamas and sheep. At 11,000 feet occur a few potato fields and lower still in succession one sees blossoming orchards and vineyards, thrifty vegetable gardens, masses of violets, hyacinths, sweet peas, and laden orange trees. Throughout the whole descent one sees at every turn the barley fields on the alluvial fans tributary to the main valley. The gradation in the size of the villages is as regular and certain as the downstream increase in the sizes of the alluvial fans.

The control over the distribution of the population of this section by alluvial fans is perhaps best shown on the continuous piedmont slope from Oruro 150 miles south to and

Bowman

FIG. 203. IRRIGATED ALLUVIAL FAN WITH RADIAL DISPOSITION OF CULTIVATED FIELDS, ABOVE LAMBRAMA, PERU. ELEVATION 12,100 FEET

beyond Uyuni. Upon this fringe of alluvium is gathered more than 50 per cent of the whole agricultural population of the altiplano of Bolivia outside the department of La Paz. The railway from Antofagasta serves and encourages them all, Challapata, Machacamarca, Poopó, Huari, Separayo, and many others. The mining development has been chiefly in this margin of the eastern highlands; and the agricultural towns, by the sale of barley, vegetables, meats, blankets, and the like to the mining towns, have been stimulated to develop their agricultural lands to a marked degree. A final cause which must not be overlooked is the relatively greater constancy of the water supply on the whole piedmont strip.

Here one finds often in short distances neat cross-sections of the life of these highland people. In the plateau, as at

Huynuni, are a group of tin mines at the head of a valley discharging westward to the interior basin; the valley itself is farmed at favorable localities and at its mouth is a widespreading alluvial fan that reaches far out toward the center of the interior basin; the head and intermediate parts of the fan are cultivated and marked by prosperous villages and gardens; the outer edge, more poorly watered, is used for grazing and is dotted here and there with the huts and corrals of the llama herdsmen; while beyond this, to the southwest, are the white, salt-incrusted surfaces of the salars adjacent to Lake Poopó. The mine on the mountain slopes, the village clustered about the concentrating works below, the railroad out on the pampa, and slow-moving caravans of llamas, bearing barley, merchandise, and salt, complete the view. From a single position one may thus mark the whole range of the highland dweller's activities.

CHAPTER VIII

BEYOND THE ESSENTIAL FACTS
REGIONAL GEOGRAPHY. ETHNOGRAPHY. SOCIAL GEOGRAPHY. HISTORICAL GEOGRAPHY

1. *Human geography and regional geography: Islands of the sea, countries, and natural regions.*
2. *Human geography and ethnographical geography.*
3. *Social geography.*
4. *Political and historical geography.*

I. HUMAN GEOGRAPHY AND REGIONAL GEOGRAPHY: ISLANDS OF THE SEA, COUNTRIES, AND NATURAL REGIONS

From the two preceding studies it is easy to conclude that the human facts might be observed in like manner in the two other types of islands: islands of the great forests and islands of the sea.

In chap. V, § 2, apropos of the Fang, we have shown how the geographical and human phenomena characterizing actual "islanders" of the immense equatorial forest may be analyzed.

Islands have long been favorite themes in geographical and historical science—since the beginning of our own Mediterranean history and in antiquity, since the universal rise of the Anglo-Saxon empire in modern times, and since the advent of Japan as a great international power in our own time. To say nothing of those all-powerful archipelagoes, Great Britain and Japan, there have been excellent studies of smaller islands, such as Corsica and Sicily as well as of more distant groups such as Hawaii or Java. And how many tiny islands have been made the subject of monographs!

We may even consider that, as a result of the definiteness of their limitation by the sea, islands have called forth the first true regional monographs. Nothing can better show the real connection between the method here set forth and the general

method of regional geography than a coördinated collection of notes on a group of islands.

How the Geography of Islands Is True Regional Geography. An Example of Islands of the Sea: The Two Large Balearic Islands

The largest of the Balearic Islands, Majorca, is bordered on the west by a great high, rocky sierra. It extends from the southwest to the northeast, reaching in the Puig Major its highest point of 4,741 feet (1,445 meters). Facing this sierra on the east and running in the same direction is a less mountainous region, a large limestone plateau strewn with intermittent groups of hills whose highest points do not go much beyond the modest height of 1,600 feet (500 meters). This eastern region, especially the strip along the shore, is rich in famous grottoes, some of which deserve to be counted among the most beautiful in Europe: the grotto of Arta, the "cueva del Drach" or Grotto of the Dragon, etc.[1]

Between these two approximately parallel ranges is a plain like the wide bottom of a boat, covered with rich erosional soil and broken only here and there by low hills from 325 to 490 feet (100 to 150 meters) in height. At the southern end of this vast central depression is the beautiful Palma Bay; it is also deeply indented on the north by the Bay of Alcudia.

All the most flourishing and crowded life, almost all the rich and populous cities, the oldest land roads, and all the railways now built are on the flat and fertile lands of this huge, wide central furrow, or at least on each side of the furrow, upon the first low bordering heights, which are rather additions than boundaries. Inca and La Puebla, Alaro and Petra, Manacor and Felanitx, small cities in the center of Majorca, are already served by the short but prosperous system of railroads and are all true economic centers.

Almond trees predominate in all that large part of the island that extends in the center from Palma to La Puebla and to Felanitx and Campos. Here and there gardens of olive trees, arranged like those of the almond trees, continue this magnificent open forest, and at intervals also the dark foliage of some

[1]See E. A. Martel, "Les Cavernes de Majorque," *Spelunca*, V, p. 32, with a map and numerous illustrations.

few large carobs or the ashy-gray trunks of a few fig trees are mingled with the almonds. But the olive and fig trees are found more particularly elsewhere. The olives are the predominant trees of the foot and the first slopes of all the western sierra, ascending the mountain to a height of 1,300 feet (400 meters). Fig trees are especially cultivated in the northern and northeastern part of the great central plain.

All these trees, olive, fig, and almond, furnish very valuable crops. Olive oil and figs and especially almonds are exported. In the year 1909 almonds were exported from Majorca to the value of $2,900,000 (15,000,000 pesetas—the figures are nearly exact), and in the year 1910 to the value of $3,475,000 (18,000,000 pesetas—the figures are less certain). But that is not all. This is the harvest of the upper level, a few feet above the ground. We must also include that curious "undergrowth" cultivation—cereals, vegetables, pimentos, potatoes, or beans—which yields a double harvest yearly. One harvest above and two below—that is the product of this rich soil, divided into squares and rectangles by the checkerboard of walls.[1]

But what incessant and repeated labor! The branches of the trees are as if weighted by the care spent on them by skillful arboriculturists, and beneath them the ground shows everywhere the marks of devoted human toil. As we walk beneath the canopy of white blossoms and near the twisted and knotty trunks of the olive trees which tell such an old, traditional story of life with men, we gaze at the faultless rows of beans or observe a carpet of springing barley, so smooth that we might well think that some wonderful green tapestry had been spread beneath the leafy and flowered branches.

Sometimes the cultivation is of a still more mixed character, but the mixture is always one of intelligence, regularity, and harmony. Between Manacor and Felanitx there is a "closed garden" bordered on the inside throughout the whole extent of its gray inclosures by a row of tall almond trees. Its center is filled with lines of large fig trees, while throughout the

[1]For an exposition of this method of simultaneous cultivation above and on the ground, which she terms "interculture," see Ellen Churchill Semple, "Influence of Geographical Conditions upon Japanese Agriculture," *Geog. Jour.*, XL, 1912, pp. 589–607.

inclosure are grapevines, cut at intervals by beautiful straight strips of beans.

And everywhere, in the rice fields of Albufera, in the vineyards of Binisalem, in the beautiful *huerta* of Soller with its famous orange trees, we find the same carefully ordered work.

But whence come the workers to meet the demands of such incessant toil? The population is relatively dense. Upon 1,350 square miles (3,500 square kilometers) there are 250,000 inhabitants—nearly 200 inhabitants per square mile (nearly 75 per square kilometer)—that is, twice the average for the Iberian peninsula (which has the modest number of 14 per square mile), a large average for a country of which a part is very mountainous. And above all, the Majorcans are persistent and admirable workers.

"Here the very young children go to work in the fields, and, young as they are, do the work of women; the women do the work of men; the men do the work of beasts of burden!"

The children are taken to the fields at an early age and almost as soon as they can walk begin to pick up a few almonds or olives. As families—in this small section of that great region of family life, the Mediterranean world—the Majorcans live all day in the open fields, near the furrows and the vine-shoots, in the shadow of their orchards, which are also gardens, where the slender fingers of the little children as well as the weak arms of the worn old men and women find employment.

Save in the exceptional region about Palma, the country district is bare of houses; only here and there are some little *casas de guardia* which are simply the equivalent of the *bastidon* or *capite* in which, in other countries, the tools and baskets for grape-gathering are housed for the night. At Majorca a guardian sometimes passes one or two months watching the approaching harvests or the trees laden with fruit. Sometimes he even lives there temporarily, and as soon as the figs are ripe enough so the pigs can feed on those that fall, eight or ten of these animals are brought to live there with him. But this is an exception.

In medium-sized or small islands, like the Balearic Islands, and especially outside of large cities like Palma, the capital of Majorca, we recognize the distinctive features of ancient

Mediterranean life. Almost all the Mediterranean peoples, preëminently "urban," have grouped themselves in settlements with houses closely crowded together, so closely that they have the appearance of small cities even when they are only simple villages. A life concentrated around the public square (*agora* or forum), around the bastion or stronghold, the temple or the church, is preëminently a life of house close against house. Such are many of the small Majorcan cities —Selva, Pollensa, Manacor, etc. None of them is more typical than Alcudia. Cleverly situated politically in the middle of the flat isthmus of the mountainous peninsular cape on the north which separates the large bay of Alcudia from the still larger bay of Pollensa—the *Puerta Major* from the *Puerto Menor*—it remains shut in by its girdle of strong walls pierced only by narrow gates. It is all crowded about its massive church, a church without high steeples, which, when seen from a little distance, dominates magnificently the sky line of the city.

One of the general and necessary consequences of this concentration of life is to separate the inhabitants from most of the lands which they have to plow and sow. Every day they must betake themselves to the fields. In Majorca an ass or mule is harnessed to a two-wheeled cart upon which are loaded persons and tools. Fortunately the light plow, with small plowshare, is easily carried. They unharness at the entrance to the garden and, if they are to plow, the ass or mule passes from the shafts of the cart to the plow. When night comes he draws the whole load back to the town.

Thus there is a double migration, morning and evening, taking place with the regularity of the tide. These migrations are very short, but they are migrations of considerable numbers; in a single hour of the late afternoon along a bit of rough but lovely road between the olive trees on the way from Pollensa to Alcudia, was observed a veritable procession of carts returning from the fields; ninety-seven family groups, on their way home after a days' work. The cart loads were charming: here, behind the father who held the three leather thongs of the reins, were seven children grouped about their mother; there, two women in mourning, mother and sister doubtless, with three little girls with great black eyes;

in another wagon, two old people, a man and a woman, were crowded upon the seat beside the youthful driver, once more an entire household going home after work.

Now this was only one of the roads leading to the city, and nothing has been said of the less numerous and poorer cultivators who were coming back on foot, or of those who, though having no cart, had an animal and were going home perched upon its back, often two and sometimes three of them, or of those who were following on foot their mule or ass, loaded with branches or vine-shoots for the kitchen fire, or with cabbages, vegetables and grass as food for men or animals.

Unlike so many small "gardeners" of the Far East who for their work and their life remain much more shut in between the walls of their gardens, the Mediterranean cultivator moves about; he must and does organize his movements. The man who handles the plow must also know his roads.

Is it for this reason that he is so inclined to migrate and to emigrate? Perhaps this daily habit of going to a distant field of labor has something to do with those larger movements from shore to shore. The nearness of the "men of the sea," fishermen and carriers, is especially the social fact that educates the cultivators to the idea of leaving home.

Generally in Majorca the fishermen do not mingle with the cultivators; but the cultivators need the little fishing boats for their products. Life on the island is becoming less and less self-sufficient. The Majorcans export their almonds or their olive oil to Marseilles or Catalonia, their oranges to Port-Vendres or Cette. They have on the opposite shore as a market for their garden products the large and rich city of Barcelona. To these regions, or to such cities as Valencia and Alicante, they go for what they need. In short, the roads of the sea are the natural roads of approach and expansion for their little cities and their gardens.

With the exception once more of Palma, which is for Majorca, considering its size, the enormous, abnormal, and solitary geographical urban fact (64,000 inhabitants), cities and ports are distinct. But each city in the strip along the coast has its small port, which is not a simple dependent annex. This group of inhabitants who own boats and who live from the

sea shows its material independence by the long distance that separates it from the other town. In the western region of the great sierra the port of Andraitx is one mile (two kilometers) distant from the village; Soller has its port upon a very pretty harbor almost two miles (three kilometers) away and entirely outside the *huerta*. Pollensa, which belongs both to the zone of the Sierra and to the northern shore, is separated from its port by four miles (six kilometers), Alcudia by one (two kilometers). In the mountainous region of the east especially, the cities, with the desire to share in the economic and cultural life of the central plain, have located far from the sea. The consequence is that Puerto Colon, the port of Felanitx, is five miles (nine kilometers) from the city and the port of Manacor is seven miles (twelve kilometers). Even at Palma the greater number of the fishermen and sailors do not live in the city proper but outside the walls, in the whiter, more commonplace, and poorer suburb of Santa Catalina.

And yet, while not mixing, the toilers of the sea and the tillers of the soil are mutually helpful and closely associated; they could not get along without each other; they are the two parts of a whole. They must have had a strong influence upon each other, and many traits and aptitudes of the landsmen owe something to this contact with sailors.

The fishermen of Majorca catch tunny-fish and lobsters, but they also spend much time in the coasting trade. In this they are another essential survival of Mediterranean life. When for some weeks in the spring lobster-fishing is prohibited on the coast of the Balearic Islands, the boatmen of Soller find employment in going to Valencia and to other ports of the incomparable Spanish *huertas* for the early vegetables which the islands do not yet have, particularly early tomatoes, for the Majorcans are almost as fond of tomatoes as of pimentos.

Soller is a port of the western sierra, that is of the true mountainous region of Majorca. It is situated near the middle of that splendid coast, rugged and indented, which runs along the west of the island from southwest to northeast, from the Dragonera to Cape Formentor. It is dominated by the highest summits. We have here the finest type of those twin

agglomerations: a wonderfully cultivated oasis, lying sheltered and as if hidden in the midst and at the foot of the arid, stony "wastes" of the high slopes, and a cove forming an almost perfect circle with a narrow opening toward the sea—an ideal port, lying sheltered and as if hidden amid the dangerous reefs of the coast.

Soller is the second port of Majorca; it seems to have a more ancient and remote life than the capital Palma, founded by the Romans, a port and fort. To-day two beautiful roads cross the Sierra, ending at the *huerta* and the port, but for centuries the only means the inhabitants of Soller had for getting out of this shady nook, this verdant "bowl" (some connect the name Soller with the root *olla*, pot), were the mule paths that climb the steep slopes, and the shining and limitless roads of the sea beyond the port. The people of Soller make daily trips to all the opposite shores of Catalonia, Languedoc, and Provence. They know all the markets of southern France; they know and frequent those which are much more distant, even as far as the shores of the English Channel. The daring emigration of the people of Soller even takes them as far as the Antilles. French is spoken almost as much as Spanish on the quays and in the streets of this busy city. Such is the result produced by the isolation of a food-producing garden in the midst of mountains, when this isolation is broken by the addition of a beautiful harbor.

The great sierra is thus "populated" at different altitudes by skillfully irrigated oases. At the very head of an immense rocky defile, like the one through which passes the narrow canyon of the torrent of Pareys with its wonderful whirlpool sculptures, is the small closed and cultivated basin of Aubarca. Everywhere rise the tall gray summits which bear even on their crests, although more and more scattered, the stubborn tufts of the Balearic wastes along with a few northern plants, while at their feet spreads out the magnificence of those privileged spots, Deya and Valldemosa.

Over vast stretches of the mountainous region of the west are seen rock-roses, myrtles, rosemary, milk-vetch, boxwood, asphodels, and the *Chamaerops humilis*, the dwarf palm or *palmito*, the most northern representative of the large family

of palms and the one that in the wild state can brave the cooler and drier climates. It occurs in southern Spain and Algeria only in the form of a creeping clump spreading over the ground like an octopus, while in Majorca it grows tall enough to form bushy thickets and sometimes a small tree. In places in the Sierra where the soil is a little less calcareous and contains somewhat more humus, the thinner, lower, and drier tufts of the *garigue* run imperceptibly into the bushy shrubs of the *maquis*, relics of the underbrush of former forests, now devastated, of cork and evergreen oaks. A few thick patches of these evergreen oaks still remain here and there.[1]

Then suddenly on the spotted mountain sides we see the evidence of the toil of men in the shape of walls rising above each other, remarkably built and finished, which support the olive trees. On the way up to Nuestra Señora de Lluch, and close to this famous pilgrimage, olive trees have even been planted and cared for in the midst of the broken patches of the calcareous *lapiaz*. Often the olive groves stretch over acres of broken ground far from any house or village. Throughout Majorca, except, as we have said, near Palma, the field and the garden are far away from the village or city, but it is here in the Sierra that this fact is most striking. For long miles before reaching any inhabited center we see the silent evidence of the presence of human hands. Walls are kept up; the trees are trimmed and the earth beneath them has been newly turned over. An eager desire to save the precious humus and the water from the too rare showers has made a series of small sustaining walls cutting the slopes of the less steep valleys, which resembles the stair-like succession of those works that are meant to "soften" the violence of a torrent in the Alps. And all that with no man in sight, for the inhabitants are not numerous and they manage to distribute their toil over wide stretches.

At the present time *dry farming* or *dry land farming* is becoming an important fact in America, with all the noisy fame of a success that is both scientific and practical. But the laborers of the Mediterranean world have long used this

[1]See R. Chodat, "Une Excursion botanique à Majorque," *Bull. des travaux de la Société botanique de Genève*, XI, 1904–1905, as well as the two illustrated volumes by the Archduke Louis Salvator, *Die Balearen in Wort und Bild*.

method in the cultivation of their olive trees, their wheat, and their vines; they have known for twenty-five centuries at least that repeated workings and constant tillage of the soil are a wonderful means of preserving the scant water of the depths and the capricious water of the rain.

Here in Majorca, where almost all the cultivable soil is utilized, one has at times literally the impression of crossing immense deserts, silent and uninhabited, and cultivated seemingly by good genii.

The island of Minorca, situated east-northeast of Majorca, resembles the larger island more than has been generally believed and is more closely connected with it than appears. It is really only an incomplete continuation of Majorca; it continues only the eastern part, the part of the calcareous plateaus dominated by scattered hills to which too often is given the overambitious name of Sierra of the East.

A great line of fracture crosses Minorca from one side to the other, from west to east; while the lands to the south are relatively recent, other calcareous lands, much more ancient, occupy the north of the island. But, while there is a geological contrast between the two regions, there is nevertheless similarity in geography and appearance.

It is then a sort of great stony tableland, humped and broken in its center by irregular heights of from 650 to 985 feet (200 to 300 meters); over a large part of its circumference it ends toward the sea in abrupt cliffs from 65 to 100 or 130 feet (20 to 30 or 40 meters high). The waves of the Mediterranean, so often storm-tossed, break against these hard walls of gray rock and slowly disintegrate them. Entire strips crumble down and the uneven shore line becomes ever more broken and irregular.

The edge of the rocky plateau thus overlooks the waves, with no gentle slopes to the level of the water forming easy communication between land and sea. Fortunately the sea, by the sinking of the land, has invaded the terminal channels of a few streams, and pushing forward steadily toward the interior, as the flood of the high tide may do intermittently on other shores, has established itself in these elongated harbors for the security and, in time of tempest, for the salvation of man.

Curious indeed are these ports of Mahon or Ciudadela, long winding guts or bays in which the sea seems to flow as between banks. The slope of the ancient river bed can still be followed on the floor of the narrow bay and continues very gently upstream. After the winding gulf with no sharp fall comes the open valley, its sides harmonizing with those of the port, and the slopes of small tributary valleys seeming to meet by prearrangement the slope of the main valley. The water of the small main *rio*, dammed by the sea, is reduced to such a feeble current that it is filled with grass and is almost stagnant. Thus, for example, the little river of Mahon, a slender thread of water a few feet wide, flows noiselessly along, and disappears, only to reappear in the midst of a sheet of green like a bed of watercress.

Since the sea stops its outlet the current is hardly any longer a current, but the wide valley hollowed out in the calcareous plain by the river in former times is still there with its alluvium and its subsoil filled with water from which the *norias* may draw. This rich and sheltered lower level has become the region of gardens, the *huerta* of Mahon. It is the "practice school" of those patient and expert horticulturists of Mahon who have carried into Algeria especially and into the province of Oran, to Bel-Abbès and elsewhere, the benefit of their persistent agricultural training.

Of the old valley shaped in other days by the violent waters what remains to-day? A checkerboard of shrubs and vegetables dotted with little white houses, which ends exactly at the artificial wall where begins the port dotted with white sails—a long and narrow gulf, called a *cala*:[1] a gulf and a garden. It is a garden which has but few acres and which is insufficient to feed a population of 18,000 inhabitants. It has been necessary to create fields and gardens on the top of the plateau where the rock crops out at all points. The Minorcans have cleared away the whole surface, stone by stone, not only in the immediate neighborhood of Mahon, but, one might almost say, throughout the entire island. They

[1]See the report by Jean Brunhes to the Académie des Sciences, "Sur les confusions entraînées par le pseudo-terme morphologique de *cala*. Comptes rendus," meeting of March 27, 1911; and see "Les *Calas* des Baléares" in the volume *Hommage à Louis Olivier*, 1911, pp. 55–62, and 8 figs.

have piled up these stones in innumerable walls from three to six feet in height (one to two meters), which serve not only as a means of getting rid of the stones, but also as protective barriers. The north wind is frequent and strong, and blows so cold as to be fatal to the plants. On these plateaus even the thickets of boxwood and wild olive grow straight up only as far as the tops of the walls; when they reach this level they bend over and lie in oblong masses toward the south.

"There is little ground, but it is good," say the peasants of Minorca. It is an earth that comes from the decalcification of the limestone and is a rich, reddish, ferruginous earth, which lodges with varying thickness in the furrows and pockets of the rocky surface. It constitutes property *par excellence*, for it makes possible the growth of wheat, oats, vine, and fig trees, and it is treated with jealous care. In the suburbs of Mahon between the capital and the pretty town of San Luis, upon small pieces of ground always inclosed with large walls, people build villas. But first the projecting limestone is scraped in order to gather up all the patches of vegetable mold. Men, with little curved spades, may be seen cleaning all the irregularities of the stone, as one might clean valuable fossils, and gathering bit by bit even with their hands all the crumbs from the feast.

At the other end of the island, in the neighborhood of Ciudadela, the plateau is still more stony and barren. It is, however, always between the great gray walls and even among the broad slabs or projecting ridges of rock that the stalks of wheat grow tall and beautiful. Where else could one find such paradoxical specimens of fruitful cultivation in a poor and dry country? And how can this marvel be explained except by the ancient methods of Mediterranean dry farming?

All the central part of Minorca, more broken and mountainous, is also more favored; it has hollows where the vegetable mold has accumulated; there are fields where one may plow without the plowshare striking the hard stone, and the hills form helpful screens which protect the plants from the too direct effect of the wind. The chief wonder is then not here, but upon the outer edge where the citadel ports (Ciudadela means citadel) have necessarily been established and where the city life has been chiefly concentrated.

Mahon, the present capital, which claims the glory of having been founded by Mago, the brother of Hannibal, and Ciudadela, the former capital, which still keeps from the past its cathedral and bishop's palace, are of a type entirely different from so many small cities in Majorca. From the top of the cliffs sixty-five feet (twenty meters) high that overlook the deeply penetrating gulfs, they might be posts of defense close to the sea. They are compactly built, the houses close together and immediately above the natural havens over which they keep watch.

Mahon and Ciudadela are the only real cities in Minorca. The former has nearly 18,000 inhabitants and the latter about half as many. They contain more than two-thirds of the total population of the island, attracting all the life by their situation. They have a noble appearance; their walls are partially demolished, but they still keep the air of cities with a past. Among cities, as among men, even in their decay there remains a visible sign of historic pride, which is the survival of heredity and race. These two cities are white and clean, for all the cities of Minorca, whether large or small, consist of white and clean houses, of the dazzling white of lime. It is no longer merely the splendor given by that Mediterranean light which silvers even gray or ochre; it is the true white of the layer of whitewash laid again and again upon the walls, on the outside as well as on the inside, and sometimes in Minorca even on the roofs. Everything is carefully arranged to catch all the water from the rain, and that which flows over the whitewashed roofs and through the little ditches, likewise whitewashed, maintains an exceptional purity until it reaches the cistern.

Men who have lived upon this land where the soil is everywhere pierced by the rock have been able to subsist only by constantly clearing the soil of stones. From the beginning they doubtless built walls like these of dry stone without cement, which defy the storms and the years, but they also piled these same stones upon each other without cement to build shelters or monuments, for instance the megalithic monuments called *talayots* (vaulted chambers). These structures are from ten to thirteen feet high (three to four meters) and from thirteen to sixteen feet in diameter (four to five meters), and to-day serve

only for sheep or pigs. Sometimes what is pompously called the *caballeria*, consisting of three or four asses or mules with once in a while a horse or two, are sheltered there.

Besides the circular constructions called *barracas*, rectangular buildings with roofs of two slopes called "bridges" are built for the same purpose. Upon wide lateral walls large, flat stones, three feet (one meter) in length and regularly cut, are set up, leaning one against the other and supporting each other like two playing cards. The "bridge" belongs to a more advanced art because it requires the skillful cutting of large slabs of stone.

The lower part of the walls of certain *barracas* are not less than six feet thick (two meters). What an accumulation of material to obtain such little rooms! What a waste of stones, were it not that stones are overabundant and that the problem is to pile them up in order to clear the ground, an adaptation which seems to date from the origin of man's establishment here and which has been perpetuated down to our time in varied and reduced but strictly similar forms.

In traveling through these two islands, where life is maintained with so much labor, one's thought constantly reverts to the past. All this noise of spade and mattock working the ground, all these repeated thuds of piling stone, are the prolonged echoes of an old, old tradition which contradicts the demands of modern production. How can one imagine that a population of 40,000 inhabitants could establish itself and prosper to-day upon an island like Minorca? Minorca is, everything considered, only a sterile plateau like that of the center of the Crimea, or those of the southern part of the Central Massif of France, good for shepherds and their flocks, but seemingly repelling every attempt at intensive cultivation. Now there are sheep in Minorca which, when the squares of earth and rock shut in by walls lie fallow, or the harvests have been gathered, enter these inclosed spaces and find their food there; but they are only accessories. The main thing is the cultivation of cereals, the growing of shrubs and trees, the production of those plants that can support human life.

The Balearic Islands are peopled by gardeners and fishermen. The gardeners are for the most part dwellers in cities, and

these fishermen become for the most part, if not merchants in the strict sense, at least coast traders and carriers.[1]

Miss Semple, in a chapter on "Island Peoples" in her book *Influences of Geographic Environment*,[2] rightly insists upon this "insular" association of fishermen and cultivators and she thus explains in large part the great density that population may attain.[3] This relative density is one of the most general facts. We have emphasized it in speaking of the Balearic Islands; it would appear still more clearly in Malta and the Lipari Islands; it might be verified in the Polynesian Islands,[4] and in Java and Japan it would be found to reach striking proportions.

Japan, where the arable surface is only 15.7 per cent of the total surface, has developed its agriculture to a degree of aesthetic perfection and productivity that doubtless has not its equal elsewhere.[5]

Thus islands "attract, preserve, multiply, and concentrate" men.[6] In this sense they are places of conservation, where we find, as in Minorca, survivals and archaisms;[7] there are in them species of endemisms for human beings as there are for plants and animals. But islands also become centers of expansion. Unlike plant and animal organisms, men escape by way of the sea.[8] The extreme multiplication of life within a rigorously limited environment causes forced migrations or leads to economic, social, or religious measures that tend to limit population.[9]

Examination of these small isolated worlds, always based on observation of the essential facts, leads to problems of social or historical geography and comparative geography.

These are the best fields for the beginner in observation; a comprehensive study of these little "wholes" of humanity

[1] See also "À Majorque et à Minorque, Esquisse de géographie humaine," *Rev. des deux mondes*, November 1, 1911.

[2] *Op. Cit.* "Island Peoples," pp. 408–472.

[3] *Ibid.*, see p. 450.

[4] *Ibid.*, p. 448.

[5] *Ibid.*, p. 447.

[6] *Ibid.*, p. 450.

[7] *Ibid.*, pp. 441 and 442.

[8] *Ibid.*, p. 412.

[9] *Ibid.*, pp. 458 and 464.

is the natural introduction to the study of larger and less clearly defined unities.[1]

By way of the "countries" we shall approach somewhat larger unities—the Morvan, the Vosges, the Jura, etc.—and finally unities larger still, historical and political rather than physical, such as Holland or France.

There has been a double movement in the matter of natural regions, whether small or large. Following the geologists and in reaction against false administrative uniformity and artificial political groupings, we came to believe that "countries" were fundamental constituent "cells." That is an exaggeration if not an illusion. The principle of some real subdivisions must, however, be sought in the large political unities. Then it was that the "natural region" appeared as much the consequence of "facts of humanity" as of "geological or climatic facts." It was a "result" and not a "datum." It was not an "original condition" but a "combination." This is the most excellent proof of those connections of which human geography makes a critical examination.

Paul Vidal de la Blache has tried to see how we might divide France into large regional zones, each having genuine geographical reasons and gravitating about a genuine economic center. The map, Fig. 204, is a reproduction of the map which he drew up, a suggestive résumé of many valuable observations.[2]

[1]In the first rank of such unities we place the "countries" (Bocage, Vexin or Beauce in France, Gros de Vaud or Gruyère in Switzerland, etc.).

In 1888, A. de Lapparent, in his *Géologie en chemin de fer, Description géologique du bassin parisien et des régions adjacentes*, made a brilliant attempt at the scientific rehabilitation of the old countries of France, and, so to speak, analyzed the geological foundation of the most typical of them.

L. Gallois has recently taken up again the complex problem of the *Régions naturelles et des noms de pays, Étude sur la région parisienne*, Colin, Paris, 1908, 356 pp. and 8 pls. He shows the relative and very variable meaning of these current names. The physical conditions alone can serve as a frame and a solid base for a complete geographical study. "A natural region is an entirely different thing from what must be called, for lack of a better term, an economic region. It is again an entirely different thing from a political unity." It would not be well then "to go too far and to give to natural regions an exaggerated importance which they cannot have." "The notion of natural region is simply the expression of a fact brought more and more into evidence by the observations which have been carried on for a century: meteorological observations showing that the averages for temperature and rain hardly vary in a given region; botanical observations showing in the same climates the reproduction of the same types of plants; geological observations proving that, if there is great variety in the constitution of the soil, all is not disorder, and that the very way in which the sediments have been deported, in which the movements of the earth's crust have taken place, implies a certain regularity of behavior."

[2]Paul Vidal de la Blache, "Régions françaises," *Rev. de Paris*, December 15, 1910, pp. 821–849, and a map outside the text.

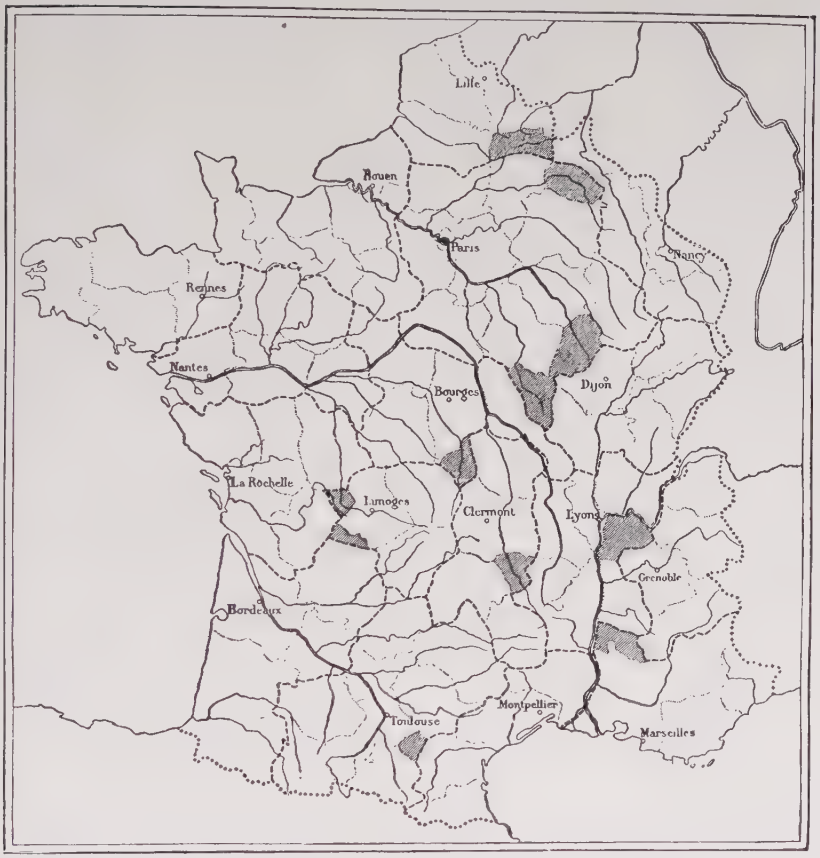

FIG. 204. DIVISION OF FRANCE INTO LARGE REGIONS BY PAUL VIDAL DE LA BLACHE

The fine dotted lines are the boundaries of regions; the dashes show the boundaries of the departments. The shaded portions represent the arrondissements which would be attached in each case to a region other than that of the chief city of their respective department. These arrondissements are the following:

Arrondissements of Saint Quentin and Vervins (Aisne)
Arrondissement of Montluçon (Allier)
Arrondissements of Réthel and Vouziers (Ardennes)
Arrondissement of Castelnaudry (Aude)
Arrondissement of Confolens (Charente)
Arrondissements of Châtillon and Semur (Côte d'or)
Arrondissement of Nontron (Dordogne)
Arrondissements of Montélimar and Nyons (Drôme)
Arrondissement of Brioude (Haute Loire)
Arrondissements of La Tour-du-Pin and Vienne (Isère)
Arrondissements of Château-Chinon and Clamecy (Nièvre)

In Belgium the Central Administration of Primary Instruction, under the intelligent guidance of Director General Corman, has been successful in obtaining a regional basis for all instruction in geography; and, to direct the inquiries of the inspectors and instructors of each region, it has published and distributed in all the schools of the kingdom a colored map of Belgium of which we give a reduced reproduction in black and white[1] (Fig. 205).

Regional geography, understood in the broadest and most general sense, must be the culmination and not the beginning of geographical research.[2] We have to-day, both in French and in German, excellent models of regional geography.[3] But how many other studies would have gained if they had been preceded by a more modest and systematic analysis of less complicated and extensive areas! Why have so many authors lost themselves in vague, half-literary, half-historical dissertations which have little if any relation to geography? In geography, as in every science, one must pass from the simple to the complex and it has been a great mistake to observe the modern state — Italy or Russia — before the natural province — the Roman Campagna or the Crimean steppe — and the province before the city, the village, the house, the road, or the

[1]This enterprise, which is all to the honor of the Board of Primary Instruction in Belgium, was not undertaken hastily, but on the contrary had long been meditated. A circular sent out by the Minister of Sciences and Arts, dated April 15, 1909, on *L'École primaire et l'expansion belge*, in which the chief question discussed was the teaching of geography — lectures on the teaching of this subject during the *Semaine pédagogique*, held in September, 1910, for the superintendents, both chief and cantonal (among them Famenne's able expositions of the regional geography of Belgium) — finally the publication of the map, reproduced here on a smaller scale, which was accompanied by a *Plan d'une étude régionale de la Belgique* and by a *Liste détaillée des régions et pays de la Belgique:* all this prepared the way for the general work which is now being elaborated throughout the kingdom. How wisely this coöperative work has been adapted to the needs can be seen by reading, for example, the report presented in March, 1911, by the Inspector of Mons — (see the review, *La Gymnastique scolaire*, May, 1911, pp. 129–151). Apropos of Belgium, and in order to make more clear the map in Fig. 205, we recommend the consultation of P. Michotte, *Atlas classique de géographie*, Albert Dewit, Brussells, 1911, 252 maps, charts, and figures. It is a sort of Sydow-Wagner's *Methodischer Schul-Atlas*, adapted to Belgium — that is, a collection of a great many remarkable maps of Belgium, physical, geological, demographical, agricultural, industrial, etc.

[2]"One can, of course, object to this conception, on the ground that it runs the risk of leading one to premature generalizations. This is possible; but then one must have recourse to protections; I could advise nothing better than the composition of analytical studies, of monographs, in which the relationships between geographical conditions and social facts would be examined close at hand, *on a well chosen and restricted field*" (conclusion of an article by P. Vidal de la Blache, "Les Conditions géographiques des faits sociaux," *Ann. de géog.*, January 15, 1902).

[3]Raoul Blanchard, *La Flandre;* A. Demangeon, *La Picardie et les régions voisines.* See again *La Champagne* by Chantriot, and *Le Morvan* by Levainville.

street.[1] In geographical monographs the point of departure is a natural, easily distinguished reality and, unless we begin with the more complicated groups of facts at the very first, we are almost sure not to go astray.[2]

The precise examples which already have been treated with some detail have shown us how clear and natural the connection is between geography thus understood and physical geography. It remains for us to show how connections may be established between the types of essential facts and the more complex manifestations of human activity on the earth. It has already been possible to see how, from the house, the boulevard, the field, the herd, or the mine, one passed imperceptibly to the examination of properly human problems in close and direct relation with these fundamental surface phenomena. The study of the small natural unities and the conclusions that we have found it possible to reach have been still more convincing.

Following this "experimental" method, which always proceeds by taking as a subject for closer study a few examples selected as types, we wish to indicate the relations connecting the essential facts of human geography with the facts that make up ethnography on the one hand and on the other with facts that may legitimately come under the denomination of social geography or of historical and political geography.

8. HUMAN GEOGRAPHY AND ETHNOGRAPHIC GEOGRAPHY

When we examine closely the six typical facts (pp. 48–52, Chap. II) at different points on the earth, we readily see that they are reduced by elimination to a very simple expression and, so to speak, to a bare form. In general, however, they are surrounded or completed by another category of

[1]There is no need to insist here upon the general value of the monographic method. It is well known what a veritable revolution the great Le Play introduced into the studies of social economy by the inauguration and organization of the monographs on the *Ouvriers européens* and the *Ouvriers des deux mondes*. It was the method of positive observation that broke the bounds of a science that up till then had remained far too theoretical and dogmatic.

[2]Among all the disciples of Le Play, Henri de Tourville, who has long been the directing brain of the group and of the *Science sociale*, should have a place apart. Pierre du Maroussem, in the course of his investigations dealing with both country and town, has well grasped the significance of natural regional unities. Finally, Joseph Durieu, in the first volume, *Les Types sociaux de simple récolte et d'extraction*, of a series announced as *Les Parisiens d'aujourd'hui* has given us very accurate social studies of an immense urban center and its periphery.

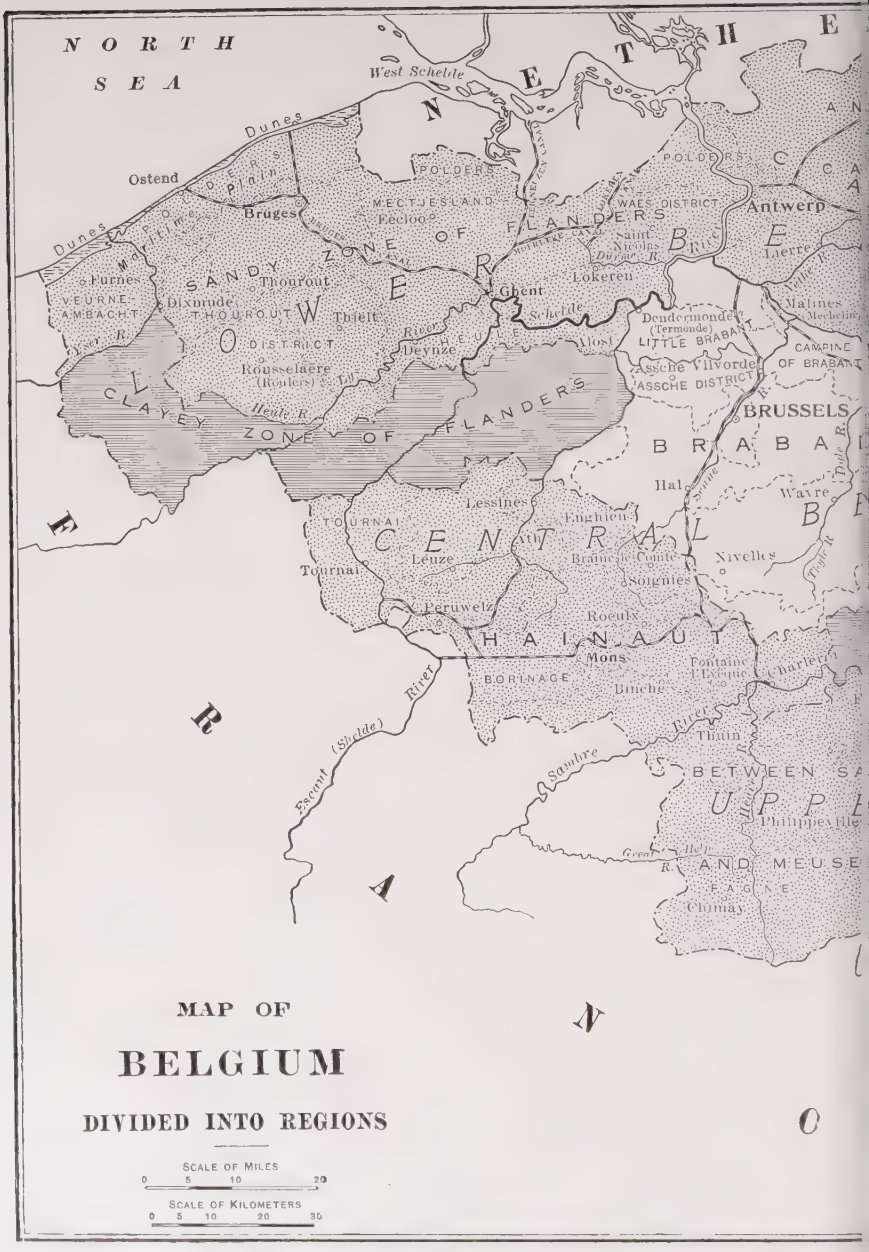
NORTH SEA
West Schelde
Dunes
Ostend
Bruges
POLDERS
MECTJESLAND
Fecloo
WAES DISTRICT
Antwerp
SANDY ZONE OF FLANDERS
Furnes
VEURNE-AMBACHT
Dixmude
Thourout
THOUROUT DISTRICT
Thielt
Ghent
Lokeren
Saint Nicolas
Lierre
Malines
Dendermonde (Termonde)
LITTLE BRABANT
Alost
Deynze
Rousselaere (Roulers)
Assche
Vilvorde
ASSCHE DISTRICT
CAMPINE OF BRABANT
CLAYEY ZONE OF FLANDERS
BRUSSELS
BRABANT
Hal
Wavre
Lessines
Enghien
TOURNAI
CENTRAL
Leuze
Braine-le-Comte
Nivelles
Tournai
Soignies
Peruwelz
Roeulx
HAINAUT
Mons
BORINAGE
Binche
Fontaine l'Evêque
Charleroi
Escaut (Schelde) River
Thuin
Sambre River
BETWEEN SAMBRE AND MEUSE
Philippeville
Chimay
MAP OF
BELGIUM
DIVIDED INTO REGIONS
SCALE OF MILES
0 5 10 20
SCALE OF KILOMETERS
0 5 10 20 30

FIG. 205. THE DIVISION OF BELGIUM INTO LARGE REGIONS AND INTO DISTRICTS

List of principal regions of Belgium:

I. LOWER BELGIUM

Campine
Sandy Zone of Flanders
Clayey Zone of Flanders

II. CENTRAL BELGIUM

Hesbaye
Brabant
Hainaut

III. UPPER BELGIUM

Between the Sambre and the Meuse
Condroz
Herve District
Famenne
Ardennes
Belgian Lorraine

From the list of regions and districts of Belgium accompanying the map, published by the Central Administration of Primary Instruction, Belgium, of which the accompanying map is a reproduction. The original map was printed in colors.

facts, likewise visible and tangible, which form, as it were, their indispensable retinue.

The inhabited house or cave is never without some furnishing and some few utensils; the road implies some "accessories" in the way of means of transportation—sliding sleigh or rolling cart; the garden or the field is cultivated by man with the help of tools—mattock, spade, or plow; the animal is trained and guided by means of a rope or leather thong, to say nothing of the complete harness which marks a more advanced stage of culture; the goldseeker and the quarryman have tools, and the hunter and fisherman have arms and nets.

These different instruments seem to envelop and "clothe" the material facts that we have described, just as clothing accompanies and covers the living reality of human bodies. Of all these "instruments" we may say what we have already said of clothes: they escape the necessity both of constant and daily renewal and of immovable fixity at a certain spot; they are all "movables." A veritable equivalent of clothes, durable and transportable, all this material is, however, like clothes, dependent in a certain measure on geographical conditions. But its relative independence is great and in civilized societies is becoming ever greater. It escapes in large part particularly the tyranny of the immediate geographical environment, and man is consequently more free to show his natural tendencies, spontaneous or traditional, impulsive or racial.

Now this group of objects is preëminently the field of ethnography. All these facts are not to be rejected or neglected by geographers, but for them they must be facts of secondary importance; they observe them and classify them without exaggerating their geographical dependence. Certain of these instruments or groups of instruments may here and there express very vividly certain fundamental conditions of the geographical environment; but, once again, the more societies become complicated and intermingled, the more these objects lose, so to speak, their geographical birth certificate, the more they tend to become uniform and universal, controlled only by the great currents of economic activity. It would then be a serious mistake to place on the same level in human geography the fundamental facts and these "objects," which are in the

literal sense of the word (for geographers, but once more not for ethnographers) "accessory" facts.

In the same spirit we might examine questions which cannot but have a great importance for ethnologists and which in certain cases are related to the geographical environment. For instance, with certain primitive peoples the problem of obtaining or of manufacturing fuel depends closely upon local or regional conditions. An example is that of the inhabitants of the high plateaus of Tibet who burn the *burtza*, a sort of moss with long roots which they mix with the *argol* (dung of the yak) and with horse dung.

It is not for us to give an exposition of just what ethnography is—that is, the exact and at the same time critical and systematic description of peoples—nor yet ethnology, which is a sort of more logical and reasoned ethnography. But it is incumbent upon us to distinguish very clearly such sciences of man or of peoples from human geography.

Who does not see at once how much more geographical are a synthesis and a map of the means of communication and transportation in Africa (Fig. 207), because they have to do with one of the six essential facts, than is a map of the distribution of musical instruments, or of various social customs, or of clothing of various textures, or of huts of various forms (Fig. 206).[1] In the habitation we approach very closely to the field of human geography, but by the predominance of the study of form, it is evident to what a degree the problems examined by the ethnologist differ from the entire series of truly geographical questions which have been studied in Chapter III of this volume. For like reasons and with the same exactitude we consider that the explanatory study of races or languages, a study that rests upon somatic or philological observations which have nothing to do with geography,[2] does not belong to human geography understood in its strict sense. That maps should be drawn up showing

[1]Fig. 206 is a reproduction of a map published in *Anthropos I*, 1906, together with an article by Bernhard Ankermann originally appearing in the *Zeitschrift für Ethnologie*, 1905, entitled "Kulturkreise und Kulturschichten in Afrika."

[2]On the subject of races, Jean Brunhes differs distinctly from F. von Richthofen, who seemed to make this question of first importance in anthropogeography, according to his posthumous work, *Vorlesungen über allegemeine Siedlungs- und Verkehrsgeographie*, edited by Otto Schlüter, Dietrich Reimer, (E. Vohsen), Berlin, 1908.

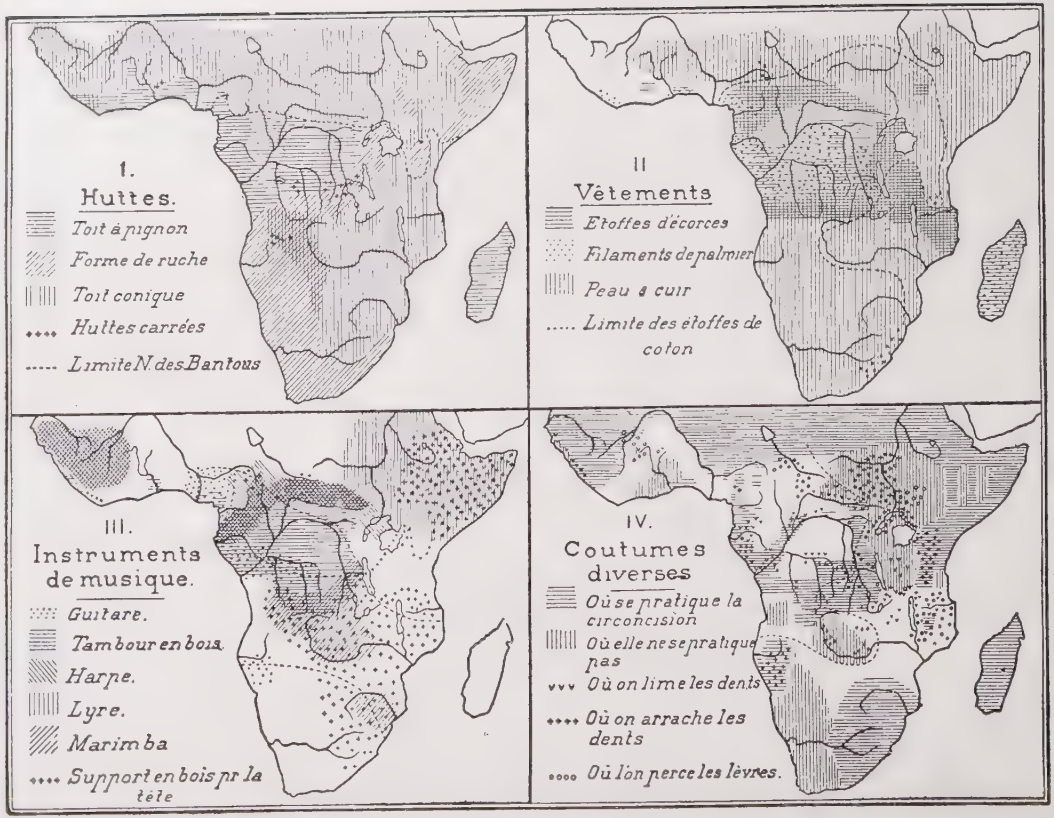

FIG. 206. GEOGRAPHIC DISTRIBUTION OF DIFFERENT HUMAN FACTS IN CENTRAL AND SOUTHERN AFRICA, BY BERNHARD ANKERMANN.

I. HUTS

Gable roof
Hive-shaped
Conical roof
Square huts
Northern limit of the Bantus

II. CLOTHING

Bark materials
Fiber of the palm
Skin and leather
Limit of cotton materials

III. MUSICAL INSTRUMENTS

Guitar
Wooden drum
Harp
Lyre
Marimba
Wooden head-rests

IV. DIFFERENT CUSTOMS

Where circumcision is practised
Where circumcision is not practised
Where the teeth are filed
Where the teeth are removed
Where the lips are pierced

the distribution of races, languages, political forms, or religions is not only proper but consistent with the demands of the positive method. It is none the less true that it is only the

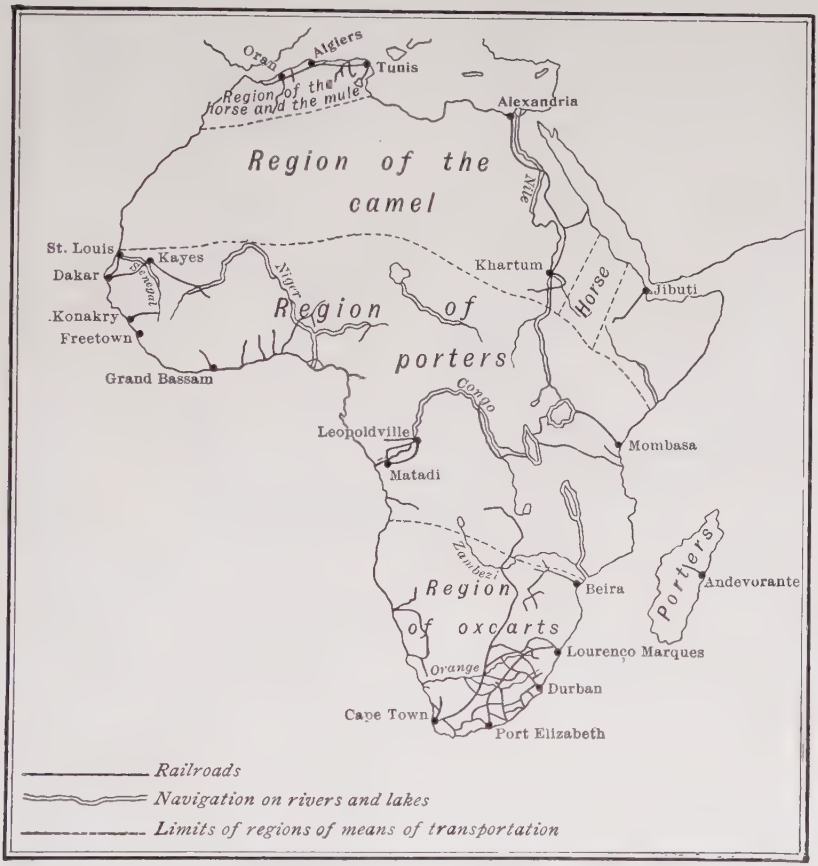

FIG. 207. GEOGRAPHIC DISTRIBUTION AND LOCATION OF THE PRINCIPAL MEANS OF COMMUNICATION AND TRANSPORTATION IN AFRICA

Map from Busson, Fèvre and Hauser, *Les Principales Puissances du Monde, Paris*, 1911

result of a real coöperation between the facts of the terrestrial world and human activity that comes within the field of human geography. We consider that upon the greater part of the facts in question the terrestrial world has not acted or does not act or that the action is so infinitesimal that with our means of observation it is impossible to see and measure it.

We should then only run the risk of encumbering with vague verbiage such important sciences as anthropology, comparative linguistics, or the science of religions.

At the most one might bring within the scope of human geography certain problems of present dispersion that have a direct relation with geographical facts. The position and the distribution of certain great natural roads of the Old World explain the distribution and the invasions of certain human groups. The ocean currents have had a certain influence upon the colonization of the islands of the Pacific, etc. And yet we think that one must be prudent in the matter of these explanations. Do not these facts rather form a part of history in the proper sense of the word, of a history which must, however, seek aid and light from all the data of geography?

Likewise there is no doubt that there is a sort of geographical classification that takes place in islands that have undergone successive invasions. The approximately concentric zones that run from the periphery toward the more inaccessible parts are susceptible of real geographic representation.[1]

Some ethnographers or sociologists have asserted that human geography was nothing but a province arbitrarily detached from ethnology and taken from it unjustly.[2] As for the geographers, some of them have said, on the other hand, that such a fixing of the limit was a detriment to geography and that geographers could not give up the specific study of races.

Let us pause for a word of explanation. Evidently geographers cannot neglect a certain examination of races and of their manifestations or their effects. Whoever uses the word "race" unites under that very vague word amalgams of physical facts, psychical facts, social facts, etc., which are very important factors, at the same time variable and determinant, of the superficial physiognomy of our earth. Why? Because these complex facts always find expression through some of the six types of essential facts. Geographers must then first of all "see" the races and groups of humanity as they are

[1]A. de Quatrefages, taking up again, in his *Introduction à l'étude des races humaines*, ideas which he had already expressed several times, has even represented schematically "the usual distribution of the Malaysian, Indonesian, and Negrito races in the islands of the Indian archipelago where they coexist."

[2]See Van Gennep, for example, in his article on the subject in the *Mercure de France*.

distributed and then "see" by what material works they express themselves upon the surface.

An example will bring out our thought more exactly.

In an article entitled *Esquisse climatique de l'ancienne Pologne*, Eugène Romer has made the following observations:

At the climatological limit of the steppes, as of the mountains, economic relations result from the climate and the human will.

The western Carpathians in the region of the Vistula are occupied by Polish colonists from the lowlands, which have been cultivated from time immemorial.

The eastern Carpathians, in the region of the Dniester, and especially in the region of the Pruth, are peopled by Little Russians who have come from the Pontic steppes.

Now, in the western Carpathians, the meadows and pasture lands occupy 20 per cent of the territory, while in the eastern Carpathians they still occupy 40 per cent. The plowed lands occupy in the west from 40 to 50 per cent and in the east only from 5 to 10 per cent. As for the forests, they are almost completely cleared away in the western Carpathians, while in the eastern Carpathians they occupy from 50 to 60 per cent of the territory.

The influence of race appears more distinctly if we consider the proportion of plowed land in the valleys below 2,300 feet (700 meters). In the parts purely Polish the plowed lands are 88 per cent of the ground and in the district of the Little Russians they occupy only 13 per cent. In the first region the production of wheat per acre is 50 per cent greater than in the second.

Thus does one of the "essential facts"—the total number of fields plowed and sown with wheat—bring out clearly, in both cases, the ruling influences, and therefore the antecedents and the present aptitudes of the groups of human beings peopling the same zone.

It is this particular manner of discerning the actual effects of different ethnical facts that must constitute the originality of properly geographical studies.

As for explaining races and modes of human population by pure geography—by the soil and the climate—as was for a time the fashion, that, in our opinion, is a false theory which is being more and more strongly disproven.

A well-known geographer offers this unique example as a decisive argument against the geographical method: "A negro can, without inconvenience, work for hours in the tropical sun, his head bare; if a European removes his helmet for a minute,

he has a sunstroke. Here is a plain fact if there are any; it bears witness to the action of the terrestrial world on the races" (*sic*).

All of which shows simply that persons accustomed from childhood to covering their heads in the open air, cannot brave the rays of a tropical sun without danger. Likewise in our temperate climate, when, for example, at the time of great military reviews, men are forced to stand for long hours motionless in the sun, some are overcome. Let us assume now, as an experiment, that accustomed head-covering be removed from all human beings. The phenomenon that is supposed to characterize the white race in the land of the black race would occur in many cases. Must we therefore assume that all these victims of the sun suddenly changed their race? Let us go even farther; in the island of Réunion, where several very distinct ethnical groups are found side by side and mingled, swamp or malarial fever, which is becoming more serious and widespread, with all its accompanying miseries, does not spare the blacks any more than it does the creoles and the whites.

With regard to races, a sort of medical pseudo-geography has been invoked against this viewpoint.[1] Nevertheless, the more the local or regional affections, such as goiter or scurvy, or epidemics such as the plague or the sleeping sickness, are studied on the spot, the more we shall be convinced that all the so-called endemic or epidemic maladies are to be explained by the persistence of some very old center of contagion, by the attacks of an insect, or by the wretched physiological condition of a group of human beings; that they are finally matters of place or circumstance and not of race.[2] Geographers should

[1]See M. Zimmermann, *Ann. de géog.*, XX, 1911, pp. 109 and 110. Also chap. X, §1, of this book, on the appropriate geographical orientation of the study of diseases.

[2]Apropos of human geography, Henry de Varigny wrote: "There is a field in which man is becoming more and more powerful: that of promoting health. For a long time extensive and rich territories have been closed, at least to an important fraction of humanity—to the most active. The obstacle was a malady due to a microbe, a pathogenic germ: cholera, sleeping disease, malaria, etc. It was apparently insurmountable; it seemed as if the white man would have to content himself with playing the part of Moses in sight of the promised land. Science is grappling with it, however; she is finding the causes of the evil and the way in which to avoid it. When we desire it, the microbes shall cease to hinder the progress of the white man in the tropics. On that day a great fact of human geography will be produced, and the more important because, if the cold latitudes are those where man is most active and most industrious, yet the warm latitudes are the ones where the soil is the most productive, and because the dependence of humanity on the tropics is more likely to increase than to decrease" (*Journal des débats*, January 12, 1911).

not be the last to recognize that more and more physicians are coming to associate taints and maladies with natural conditions. There is no complete explanation of all these phenomena in the fact of "races," nor is it to be found in geographical data alone. The one is too broad, the other too narrow.

Certainly races play a part, sometimes even an important part, in human geography, and we have recognized this fact.[1] Our task must be to show just what this part is in each particular case. Likewise the geographical environment has an influence upon races; how and to what extent is what must be made clear.[2]

Through a form of work adapted to natural conditions and through the collective training that results, societies of herdsmen or fishermen, groups of miners or planters, etc., are really modified and in the long run show definite tendencies. They may be so transformed: (1) in their physical aptitudes, and (2) in their most inveterate moral and social habits.

Ellsworth Huntington, speaking of the nomadic Khirghiz in a chapter which he calls "The Influence of the High Plateaus," among other observations remarks explicitly upon two things that expressly illustrate what has just been said·

1. *Physical aptitudes.*—The completeness with which Khirghiz life and character are determined by natural surroundings makes the relation between physiography and life far more evident than in the case of more highly civilized peoples. If the nomad is to be successful in his enterprises, the keenest of eyesight is necessary to detect cattle or encampments at a distance. I was amazed one day to hear my guide say, "Do you see those cattle off there at the foot of the mountain? They are Chinese animals—yaks." After a long search I found them, tiny specks of black. Even with a strong field glass I could barely distinguish them from ordinary cattle. That my guide should recognize them as yaks shows a keenness of sight equal to that of the most skillful hunting tribes of savages. Other Khirghiz showed equal quickness in detecting smoke, *kibitkas*, men, and animals at a distance, so that the trait seems general.[3]

[1] "It happens, moreover, that Jean Brunhes values ethnographical examples: as when he speaks of the singular likeness in appearance and arrangement of English cities in all parts of the world, and farther on, quoting from Eugène Pittard, of the German villages of the Dobrudja, which have kept a traditional physiognomy and which are astonishingly different from the Slav villages and the Gypsy encampments" (Maurice Zimmermann, "La Géographie humaine d'après Jean Brunhes," *Ann. de géog.*, XX, 1911, p. 110).

[2] E. C. Semple, *Influences of Geographic Environment*, Chap. IV.

[3] *The Pulse of Asia*, p. 125.

2. *Moral habits and social rules.*—The house of a nomad must of necessity be small, and cannot contain two rooms save under the most exceptional circumstances. A visitor must enter the room where the women are at work, or else the women must work outside; and there, of course, they cannot be prevented from being seen by men other than those of their families. Then, again, at the time of migrations there are no shelters left standing, and the women cannot possibly be kept concealed. Moreover, they cannot be made to veil their faces. No woman can work with a cloth hanging down over her face. The village woman bakes and brews and washes, and milks her few sheep and goats in the seclusion of her own courtyard, where she can throw off her veil in the assurance that no strange man will see her. The nomad woman must work in semi-publicity, and cannot be bothered with a troublesome veil, especially when both hands are more than occupied in milking some of her many sheep. Accordingly, while the Khirghiz woman is very particular about her headdress, she makes no attempt to conceal her face. She is in the habit of meeting strangers, whether men or women, and she does it modestly, though without timidity. Indeed, she makes a most admirable hostess. Her freedom from seclusion does much, both morally and mentally, to elevate her above her less fortunate sisters of the village.[1]

But let us no longer believe with Karl Ritter that the narrowed eyes and swollen eyelids of the Turkoman are the evident result of the action of the desert upon the organism, nor with Stanhope Smith that the high shoulders and sunken neck of the Tatars of Mongolia are due to their habit of raising their shoulders to protect their neck from the cold. Is it asking too much of the geographers of to-day to ask them to banish all childish finality *a la* Bernardin de Saint-Pierre? Let them make up their minds not to try to explain everything by geography.

Here are three expressions and three realities which only partially cover each other: "Arab world," "Mussulman world," "Turkish empire." Why should we expect the first fact—a fact of race—to be more directly explainable by natural causes than the religious or the political fact?

On the other hand, it is indisputable that a method of investigation and analysis of the six essential facts may render real service to all those who make a study of primitive peoples. If these facts are "filled with geography" even in civilized

[1] *The Pulse of Asia*, p. 129.

countries — and this is what we have tried to show — with all the more reason will they furnish the occasion for a multitude of observations of a truly geographical character in countries inhabited by primitive peoples.[1]

3. SOCIAL GEOGRAPHY

While we eliminate much that is generally admitted into geography, we do claim the right as geographers to enter the field of economic and social questions. Our criterion will still remain the three groups of essential facts. Only in so far as these facts explain or serve to explain the social facts by their localization or their particular forms, shall we have a right to connect certain facts with human geography. They may be grouped under the name of social geography.

For the inhabitants of the Suf, property is limited to the planted tree; it is primarily effective work which creates a certain right.[2] In an entirely different natural environment an analogous conception seems, not illogically, to control the claim to or enjoyment of property. The reader will recall what has been said of the Fang of the equatorial forest and of the many forms of their nomadism. It is not surprising that such a people, who are in perpetual movement, should have no idea that another people might be sedentary.[3]

Leading a nomadic life, the Fang have an idea of property entirely different from that of the sedentary European, for whom the soil is everything; the work of his ancestors has long given a real value to the soil. For the Fang the soil belongs to no one, hence anyone is free to establish himself on any unoccupied portion. L. Martrou relates the ironical remark of an old Fang who was patiently listening to the speech of a government official. The latter, wishing to prove the lawfulness of taxation, said that France had conquered this country

[1]The Société belge de sociologie has organized a very complete program of investigation into primitive populations. Under the direction of Cyr. Van Overbegh, they have undertaken the publication of a *Collection de monographies ethnographiques* the first volume of which is for 1907: Cyr. Van Overbegh and Ed. de Jonghe, *Les Bangala (État ind. du Congo)*, Brussels, 1907; the answers to a model questionnaire are "published on detachable sheets"; the idea is ingenious. Many facts to which attention is legitimately drawn in this vast questionnaire are not geographical; but the interest of these monographs is, none the less, very great for geographers.

[2]See above, chap. VI. In the section on the oases of the Suf, we were quite naturally led to social geography.

[3]See L. Martrou, article quoted, *Rev. de géog. annuelle*, 3d year, 1909.

and that the land was French. "Ah," cried the old man disrespectfully in his own language, "I didn't know that the French had created the earth and planted the trees of the forest."

When it is a question of establishing a new village, the old man, the "father," points out to his men the necessary place according to the number of huts that he needs for himself and his wives. A corresponding portion of land behind each hut is reserved for the owner's banana grove. If anyone comes to settle in the village, a place is given to him free of charge. If the land is already planted with banana trees, the newcomer pays the proprietor for the trees, which are carefully counted.

Thus under the direction of the "father" the people of the village choose in a friendly manner the situation of their plantations, which are all contiguous. If one of them finds his land either too small or too poor, he is free to go to one of the extremities of the village and find a larger space or one more suited to his plans.

When anyone intends in the near future to make plantations in an unoccupied place and fears that this place may be chosen by others, he marks trees at both ends with his axe and announces the fact to the village about five o'clock in the morning when all is still, so that everyone may hear him. No one thinks of contesting his location. The first clearing and the first cultivation in this region of vast deserted space create the beginning of property.

Each village has outside of its gardens and its plantations a zone of influence—its *miyoeis* ("places of coming and going"). Without being private property, this circle, which grows with the importance and spread of the village, is respected by the neighbors. The people of the village gather here the edible fruits of the trees and cut their stakes, bark, and raffia for building. Here too the women come for their kitchen wood, and in the streams and marshes they build their fish traps.

When the village is gone, the gardens exhausted, and the tall grass covers the abandoned site, the land becomes vacant once more. However, if a family wishes to establish itself in the place of another, the former owner, if not too far away, will ask a small rent of the newcomers—a goat or a gun every

four or five years—especially if the place abandoned is one that is desirable and sought after, on the edge of a lake, at the meeting of two rivers, or near a trading-post.[1]

Moreover, the first tribe will come back, if there are no enemies along the way, to fish in the lakes which it has left, and, if its new home is scarce in game, to hunt in its old haunts. But the Fang travels very fast along his nomadic road and after twenty years he is far away from these places. Others occupy them, hardly knowing who preceded them, and in a geographical sense all earlier rights quickly lapse.

How can such a life fail to influence all the life? The villages themselves feel the effects of this hurry and movement with pauses but without stop. The villages are after all only camps. They are so quickly and easily abandoned when new pressure arises! While for sedentary people the home is the most sacred thing and the word homeless is a synonym for unhappy and wretched, nomadic peoples have a general social conception that is entirely different. When a village is burned, the Fang laugh at the burning bark and the flaming hut, provided that they have time to save their boxes and their wares.

Governor General Merlin of French Equatorial Africa recently formulated what seems to be an exact exposition of all these basic social facts:

There is in fact an entirely special notion of property in these new countries. The question to whom the ownership of the soil belongs has often been discussed. Does it belong to the conquering state or to the native inhabitants? Twenty-two years of colonial experience have taught me that it belongs neither to the one nor to the other; in fact the idea of property is absent. The

[1]In confirmation of these facts, Father Dubrouillet, who spent seven years in the region of Lambaréné, gives the following: "They choose such or such a hill, because there was a village in that same situation thirty or forty years ago and because, in the forest which has sprung up anew, the soil of which has been renewed by a long rest, it will be easier to make new plantations; it will require less effort than cutting down the huge trees of the great virgin forest where neither axe nor fire has ever been. However, the newcomers must have permission from the former inhabitants in order to settle on this spot, or *éligoe*. If it were abandoned a hundred years ago, the *éligoe* is sacred and, to possess it in peace, the newcomer will have to pay a price. In this connection let me give a personal recollection. Several years ago, in a Fang village of Lower Ogowe, a discussion took place in my presence between the chief and the former occupant of the land, a Vili. The latter taking it into his head to say to the Fang, 'You clear out, you are on my "land,"' I heard the other smilingly make this reply, calling the whole assembly to witness, 'Have I not given you the price agreed upon? Tell me, you others, have I not given him "a hen and a torch"?' 'Yes, yes,' replied the assembly, and the old Vili admitted, 'Yes, that is right, you are on your own land,' and was very much ashamed."

conquering state does not possess property, since it can at any time take possession of it. On the other hand, the natives cannot possess it, since they have no such idea. They know nothing of property except to enjoy the fruits of the soil, to-day here, tomorrow elsewhere. Bare property is something utterly indifferent to these peoples who have no abstract conceptions.

Consequently I believe there is as much injustice in saying that the state has a right to the ground as that the natives have a right to it. When we arrive in these new countries the ground belongs to no one; it is in an indeterminate state, which must be determined. Now this state can be determined only by exploitation and by creating value. The ground must be given only to those who exploit it and make it fruitful.[1]

O. Marinelli discusses clearly the relation between nomadism and property. He shows that the analogy between the nomadism of the Alps and that of the steppes is due to geographical causes, which already justify an analogy between the two regions from the point of view of botanical geography; and the pastoral art, an industry that is essentially extensive, has as a necessary consequence, nomadism. But the increase in population is in direct relation to the manner of exploiting the ground; thus little by little it calls forth agriculture, intensive exploitation, and at the same time property, at first collective, and then private.

However, the examples of the ancient Germanic *marches* and of similar institutions which still persist in our own time in Russia, in Daghestan, in Java, and elsewhere, institutions whose analogy to Alpine nomadism is striking, are not to be referred, according to Ratzel, to a primitive phase of the circle of evolution of property. O. Marinelli shares this opinion and ends with the conclusion that the existence of collective properties in the Alps and their coöperative exploitation are a consequence of physical and human conditions, the pasture lands themselves resulting from the climate and from the slight density of the population. When the population increases, cultivation develops. The highest pasture grounds remain longest faithful to the type of collective property, and, if they become private property, they remain, as is natural, *latifundia*.

[1]Address given on the 9th of March, 1910, at the monthly dinner of the Union coloniale française (*Quinzaine coloniale*, March 25, 1910, p. 226).

Beginning with the minute study of the watered garden and irrigating canals and ditches, we endeavored in a previous work[1] to point out some of the social conclusions which may be drawn from a rather extended and more specialized geographical inquiry. We shall here take up the most important of these conclusions:

There are naturally arid regions into which man introduces cultivation through irrigation. He may thus modify the natural conditions that are imposed upon him. He does not create the water; he uses the water which he discovers or collects. He cannot irrigate wherever he pleases; there are arid regions which are condemned to an irremediable aridity.

Irrigation enterprises are possible only under certain natural conditions. The principle is evident, but the inference to be drawn from it has frequently been ignored. In fact we must abandon this illusion that an oasis of cultivation in an arid zone is susceptible of indefinite improvement; that one may, for example, multiply at pleasure the plantations of palm trees in an oasis. He who attempts too much and goes beyond the limit corresponding to natural conditions makes the situation worse instead of better. The examples of Lorca, of Bu-Saâda, of Ghardaïa, and of the Fayum offer sufficient proof of this.

Thus, although in a large number of cases we seem to dominate nature, she still keeps her right of preëminence, for at all points of the earth she imposes upon our activity *restrictive* conditions. Our activity, restricted in its modes and in its effects, is further subject to the influence of natural conditions in the limits within which it may be exercised.

When it is a question of exploiting the water in arid regions, that is, in districts where water is the chief means of all wealth, men cannot but submit to that effective solidarity which water often imposes upon them. In several cases where the exploited water is furnished to them by a single source (spring, stream, canal, or reservoir) and where this exploitation of the water has led them to ease and prosperity, they have clearly understood, or at least definitely accepted, this necessity of

[1] See Jean Brunhes, *L'Irrigation dans la Péninsule ibérique et dans l'Afrique du Nord*

the collective union of individual interests. But here we are approaching a very delicate question: Upon what does this correspondence between a group of natural facts and another group of human facts really rest?

When the output of available water is regularly subject to considerable variation (Valencia or Murcia, Sidi-bel-Abbès or Msila), the cultivator of the arid zones will run very great risks if a definite organization does not control the distribution. He is uncertain of the quantity of water that will be available and of the amount of water that his neighbors, through arbitrary monopolization, will allow to reach his field or garden.

Under such geographic conditions men are naturally inclined to escape from this psychological state of uncertainty and anxiety by joining their common interests under fixed laws. They then seek a normal and peaceful situation by means of regulation and an organization which will be the more rigorous and authoritative the more capricious the water supply.

Collective regulation is not determined directly by the natural conditions but is the result of a state of mind which is caused by these conditions. If there exists a necessary relation between these irregular natural conditions, which menace the individual in proportion to their irregularity, and the psychological state of insecurity, there is not the same relation of necessity between this psychological fact and the economic consequences which often result from it. It must never be forgotten that man may be powerless to free himself from this anxiety or may hesitate or refuse to do so. The egoism of some or the weakness of all may maintain anarchy. At least, if man, far from obeying the necessities arising from this state of insecurity and far from yielding to the influence of natural conditions, neglects or acts in contradiction to these conditions, they inevitably show their persistent action in the costly and abnormal effort which they always demand from human activity or by their negation of this activity. Such negation means wretchedness, disorder, economic check, as the sale at auction of Lorca, or the failure of the hydraulic enterprises of the valley of the Sheliff.

We have said that there exists a necessary relation between irregular natural conditions and a certain general disposition

of mind on the part of the cultivator. This relation is necessary, but — we must insist upon this point — it depends closely upon the character of the needs which the individuals experience and to which they are consciously or unconsciously obedient. When men living in these arid territories once wish to devote themselves to cultivation, such a relation is necessary. The same men might live as nomads raising flocks, and the necessary relation between the natural conditions and their own activity would then be a different relation. One of the factors remains constant, but the other varies according to human impulse; consequently the relation between the two varies according to the needs or desires that man seeks to satisfy. Let us not generalize the necessity of this relation; it is a function of an ever-variable factor.

In the present study this variable factor was determined. It was always the need and desire of producing by cultivation a sufficient vegetable food in naturally arid zones.

However the matter may be, the general psychological effect which certain natural conditions will produce upon the minds of a group of men plays the part of a necessary intermediary between nature and the economic facts. And if this link is the essential criterion which allows us to classify combinations of facts from the point of view of human activity, we must seek above all to recognize this effect. Now, nothing authorizes us to believe that this effect is always determined by the same natural causes; on the contrary, it has been shown that different natural causes may bring about like forms of human activity. This is one of the conclusions resulting from our observations and it deserves to be set in relief. Similar forms of human activity correspond in reality to very different geographical cases.

Water is furnished to man in overabundant quantities (Granada, Kabylia, or the oasis of Aures). Water is furnished to him more or less sparingly but in a constant volume (Tozer, Ziban, or Laghuat). Water is furnished to him in large or small quantities by individual wells dug in as large number as one may wish upon each property (Tortosa or Jerba). Here are three cases geographically very different. And yet, from the point of view of human activity, they are, if not identical,

at least analogous; they form in a certain sense one family.

In the first case man need not fear lack of water, and he gives himself up to his agricultural labors with entire peace of mind. In the second case an exact distribution must be established for water with a constant flow, but this distribution once fixed, however minute it may be, each cultivator is sure of the morrow and works the earth with no fear of lack of water. In the third case man will also run no risk and will always be certain of having at his disposal in the bottom of his well the water that he needs. In these three cases, Granada, Tozer, and Tortosa, natural conditions are such that the states of mind of the cultivator are, as far as water is concerned, states of entire security. He will have to fear only those natural accidents which dry up springs and depress the ground-water surface, just as the peasants of more humid zones must always fear the relative dryness of a less rainy year or the violent calamity of a flood.

Even in these critical and unusual circumstances what good would it do an individual to become angry with his neighbor who is overwhelmed by a misfortune like his own? He bends as a fatalist before forces whose control belongs not to him; all are equal in the presence of the general misfortune of the falling water or of flood. No one thinks of having recourse to a collective regulation of individual interests.

We might multiply examples which confirm and strengthen the importance which we have attributed to the psychological effect as the middle term between facts of the physical order and economic facts. We might cite other examples outside of the subject which we have studied. For example, is it not striking that great drainage enterprises in a marshy region incline men to the same forms of collective organization as do great works of irrigation in a dry country?

The foregoing considerations throw light on a last class of observations. If we have found in how many cases man obtains the maximum profit from water and can utilize it with the greatest perfection only by having recourse to an economic and administrative organization of a particular type, we have likewise found that this organization is not always the same, that it is not the same in all the "oases" of

the same zone, nor even in all the oases of the same geographical type. Sometimes the recognition of this common interest leads to those admirable "hydraulic communities" of Valencia or of Msila; sometimes, as Egypt to-day, the state is led to coördinate the interests of individuals with more or less skill.

Why this diversity? Is it not the task of geography to explain it? These types of organization may be connected with varied combinations of ethnical, historical, judicial, or political influences. Every historical research, every ethnographical hypothesis, every judicial study bearing upon these facts, should certainly be preceded and accompanied by a geographical study. But at this point geography stops. At least these different types interest geographers as revealing the general psychological state of a human group living within a given geographical environment. They are concrete manifestations of more or less conscious but real facts; and to the extent that they express these facts they have in their turn a geographical significance. They are connected with geography only by their point of departure and by their general orientation; their final consequences matter little to us here. To this same more or less vaguely felt need of coördination of the interests of an entire group correspond, for example, free syndicates and state organizations. That is why these types of organization, although separated by such profound economic differences, are here purposely brought together and almost confounded.

In this sense and with these reservations, the organized forms of human activity, in order to endure, must always correspond to modes, or at least stages, of the perfect adaptation of this activity to the geographical environment.

The geographical interest in the way of social geography may be pushed still further. In Fig. 207 is a map of the Iberian peninsula upon which are traced lines of demarcation: (1) between facts of climate (limit between dry Iberia and humid Iberia); (2) between facts of vegetation (zones of steppes of *esparto*). And all this is so far very natural, but we find that it is possible further to distinguish by limits described upon a map (3) facts of a technical character (zone of great reservoir dams or canal zones) and (4) facts of economic or

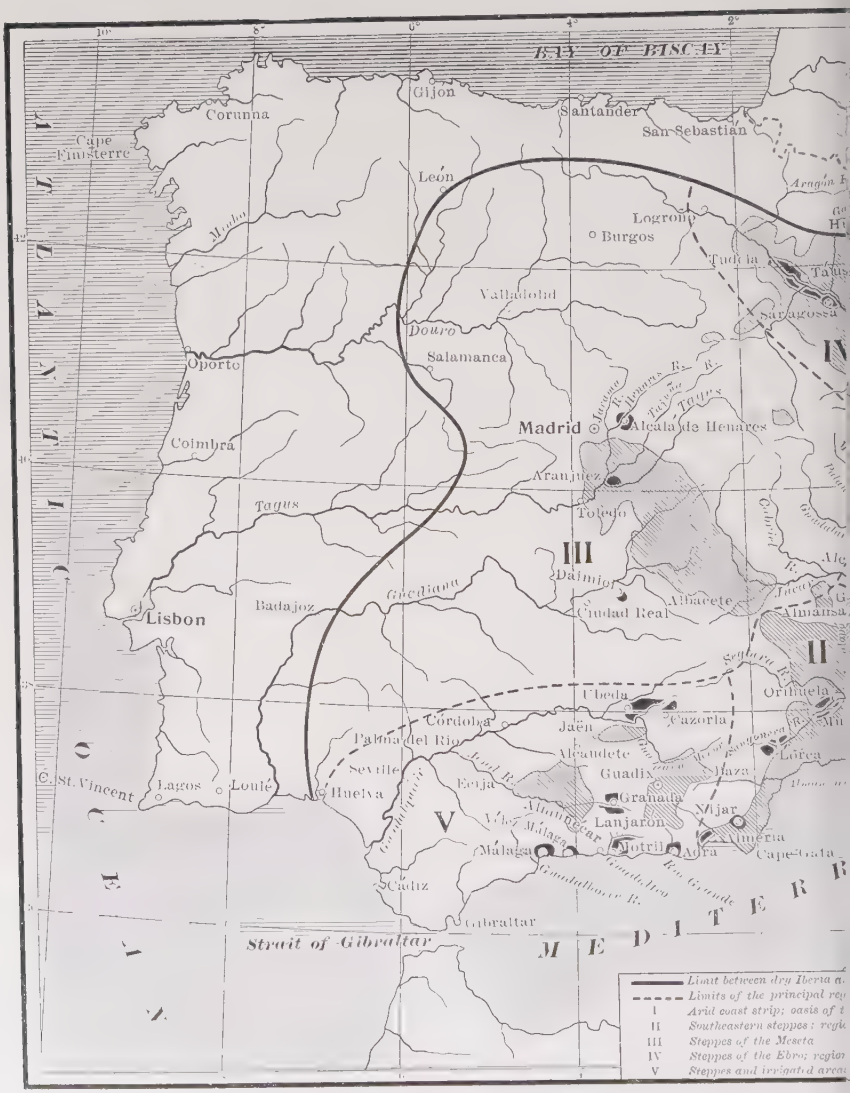
BAY OF BISCAY
Gijon
Santander
San Sebastian
Corunna
Cape Finisterre
León
Logrono
Burgos
Tudela
Valladolid
Douro
Zaragoza
Salamanca
Oporto
Madrid
Alcalá de Henares
Coimbra
Aranjuez
Tagus
Toledo
III
Dalmijo
Ciudad Real
Albacete
Badajoz
Guadiana
Lisbon
Ubeda
Orihuela
Córdoba
Jaén
Cazorla
Palma del Rio
Alcaudete
Lorca
Seville
Guadix
Baza
C. St. Vincent
Lagos
Loulé
Huelva
Ecija
Granada
Nijar
V
Lanjaron
Almeria
Málaga
Motril
Adra
Cape Gata
Cadiz
Gibraltar
Strait of Gibraltar
MEDITERR
Limit between dry Iberia a
Limits of the principal reg
I Arid coast strip; oasis of t
II Southeastern steppes; regio
III Steppes of the Meseta
IV Steppes of the Ebro; region
V Steppes and irrigated area

FIG. 208. THE GEOGRAPHIC PROVINCES OF THE FACTS OF IRRIGATION IN SPAIN.

In this map are traced the lines of demarcation between facts of climate and facts of vegetation. Maps could also be prepared of the technical facts or the economic facts connected with irrigation, just as a map of agricultural products or vegetation is prepared.

The original of this map appeared for the first time in the author's book, *L'Irrigation dans la Péninsule ibérique et dans l'Afrique du Nord*, Paris, 1902; after this it was reproduced in the volume: *Espagne, 7e Série: Système d'irrigation*, of the International Colonial Library. The engraving from the latter work was kindly loaned by the general secretary of the International Colonial Institute.

social organization (zone I is the zone of the *huertas*, such as that of Valencia, without reservoir dams, in which the marvelous prosperity is due to the collective discipline of the "hydraulic communes"; zone V, on the contrary, which includes the *vega* of Granada, corresponds to the social fact that in this region there is no real authoritative collectivism for the utilization of water).

As another example let us take up once more the study of the coal mine, and from those observations of a material and tangible character let us pass to moral and social considerations which quite evidently result from the actual conditions of the great mine, from the work in the mine, as well as from the phenomena of human geography caused by and associated with coal—the industrial city and what we have called the tenement in the factory city. We have noted the city built on the very edge of the mine and sheltering the workmen, who live exclusively by means of the mine. Around the shafts of Anzin live thus 15,000 workmen and 50,000 persons.

The *Science sociale* (VII, 421) has well shown the consequences resulting from the very formation of this fact of human geography. A permanent contact is made between families which are connected neither by traditions, nor by relationship, nor by reciprocal interests:

"Crowded together, in the workmen's houses which resemble barracks in which both air and space are lacking, the families lose the autonomy, the independence, which is assured by the isolation of homes. . . . The children grow up on the staircases and in the streets. . . . . The parents are both busy and cannot trouble themselves about the children. . . . . The loss of parental authority is particularly serious here because it takes place at the very moment when this authority would be necessary in the midst of the social complications of the agglomeration . . . . . " The whole problem of moral education might here be grafted upon these fundamental considerations of social geography.

The first social results of the advent of coal in England have been thus judged by F. Le Play:

Parliamentary investigations carried on with firmness taught the world that English society was struck by nameless calamities and

that several of its urban and manufacturing agglomerations were falling into a degradation to which official language sometimes applied the word "bestiality."

The present era of coal and machinery first of all placed people in entirely different conditions. Workmen were suddenly gathered into vast factories far from all the material and moral resources which had heretofore been considered indispensable to the existence of any society. Recruited in large part among the improvident or vicious types who would not have been kept by their old employers at any price, they were but little suited to educate their children, and although receiving good wages, they could not even have homes which were compatible with the preservation of moral order.[1]

Populations gathered together for the work of the great mine — and the great mine is preëminently the coal mine — no longer have any fixed and strong attachment and are no longer sustained by the old corporations, such as the miners' corporations of the Harz so well described by Le Play.[2] Since no other kind of activity creates between all these individuals either reasons for or places of exchange, the small merchant — the wine merchant and grocer — will play alone the rôle of necessary intermediary between all these people who have been torn away from their original place by coal. We pass over all the economic, moral, and electoral consequences of this fact which is associated with geographic conditions.

Let us go farther. The nature of the coal mine itself has made of it the first exploitation which has required very great capital. Thus great stock companies have arisen and developed; they have had the very grave effect of completely separating, not only through the conflict of interests but also through distance and through all the activity of their lives, the stockholders and the workmen, who by their work make the stock productive. To the workmen the stockholders are only far-off, unknown beings; to the stockholders the workmen are only nameless persons. Thence come so many injustices and so many acts of violence, which in all

[1] On the whole social revolution caused by coal, one should read the vigorous pages of F. Le Play, *Sur les Éléments de désorganisation sociale introduits depuis un siècle en Angleterre par l'exploitation des bassins houillers.*

[2] F. Le Play, *Les Ouvriers européens*, 2d edition (Tours, 1877), Vol. III, *Les Ouvriers du Nord et leur essaims de la Baltique et de la Manche*, chap. III, Mineur du Hartz (Hanover), pp. 99–152. The system of miners' societies explains the relative prosperity under mediocre conditions.

countries have necessarily accompanied the exploitation of coal mines.

With the coal mine are connected, as we have said, all the chief forms of great industrial activity. Likewise, with the agglomeration born from coal are connected the modern types of enormous urban agglomerations. Many moral and social consequences of the organization for the working of coal must also be charged to other industrial exploitations; many of the moral and social features of life in the coal groups are found in all the large, overpopulated cities.[1]

If, with Dr. Bertillon, we called an overcrowded dwelling every dwelling where there are more than two persons per room, we should count in Paris 72,705 households with 332,000 persons who inhabit dwellings of this kind. At Budapest in 1891 nearly 200,000 inhabitants occupied dwellings with five persons per room.[2] From the point of view of physical, moral, and social hygiene the large, overcrowded house is deplorable. It means contagion of disease and vice, it means promiscuousness and a fatal reduction of the birth-rate—phenomena which demography finds in all great urban agglomerations—in New York and Berlin and Paris.

In a lecture on the population of great cities the celebrated statistician, Georg von Mayr, cited the following example of decrease of birth-rate in great cities:[3]

THE NUMBER OF BIRTHS EXCEEDING THE NUMBER OF DEATHS, FOR 1,000 INHABITANTS

Year	Berlin	Prussia	Munich	Bavaria	Dresden	Saxony
1894	10.3	14.8	11.1	10.5	12.6	15.8
1895	8.1	15.1	9.1	10.9	12.3	14.8
1896	19.5	16.2	12.7	13.6	13.9	17.4
1897	10.8	15.6	11.1	12.1	13.9	15.7
1898	10.7	16.7	11.3	12.7	15.9	17.5
1899	8.4	15.0	13.2	12.6	14.1	15.9
1900	7.7	14.3	10.7	11.3	14.5	15.3

While human beings seem more and more crowded against each other, they are in reality more and more separated from each other by the very demands of the social geography of

[1] See the books and articles, of a very positive bent, devoted by Georges Benoit-Lévy to the propaganda of *Cités-jardins*, and the article by Charles Gide on one of these books: "Les Cités-jardins," *Rev. écon. internat.*, October, 1907.

[2] P. Meuriot, *Les Agglomérations urbaines*, p. 377.

[3] Work quoted: *Die Grossstadt*, p. 134.

great cities. In the city house of former times the different floors were occupied by people of very different conditions, and proximity caused by life under the same roof brought them together. To-day rich and poor no longer live in the same house; they do not even live in the same quarter — we are almost tempted to say in the same city. For the zones of great cities, which are classified and differentiated by the difference of trades and especially of conditions, constitute distinct cities, side by side within the same city, but foreign to each other and with inhabitants who too often become hostile to each other.[1]

The great modern agglomeration is a "sick agglomeration," as Count d'Haussonville has called it. The masses of beings who inhabit it, robbed of every tie which fixes them to a point of ground, with no material and often no moral home, become veritable nomads who pass from room to room and from house to house. A certain social anarchy follows inevitably from the ever-rising tide and the ever-repeated flood of these unattached beings. In the end, within these masses, favored by these changes and the thousand holes and corners of the great city, grow up forms of banditism and brigandage which resemble those of countries where there is no organized policing or of Europe during periods of history in which anarchy reigned. "Gangs" are organized and operate in London, Paris, or New York as the "bands" of the Middle Ages operated in the country districts of Guyenne or of Burgundy.[2]

Such are some of the facts which constitute the social geography of the industrial city and which are connected with the social geography of the great coal mine.

4. POLITICAL AND HISTORICAL GEOGRAPHY

Human history unfolds upon the earth, and historical facts are always connected with certain places. But here again let

[1] In Rud. Eberstadt, *Handbuch des Wohnungswesens und der Wohnungsfrage*, Gustav Fischer, Jena, 1910, there are some interesting pieces of information, examples and comments bearing especially upon the city dwelling — a work to be consulted for all geographical study of cities and great cities. There is a great deal of other information on the typical houses of the working class, gardens of the working class, etc., with a rich bibliography at the end of each chapter.

[2] Jacob Riis, in his splendid book *How the Other Half Lives*, has made a special study of the movements of the population in New York. He notes the formation of these bands of *apaches* and proves that they are nearly always composed of men without any fixed home and even without any family.

us be careful to avoid exaggeration and the invasion of fields not our own. From the fact that historians must always take account of the climate, the topography, the agricultural products, and the mineral resources of the region whose evolution in time they are reconstructing, it does not follow that all this evolution must find a place in the domain of geography nor that it can be explained by geography.

Man comes into relations with the natural environments through facts of labor, through the house he builds, the road he travels, the field he cultivates, the quarry he works, etc., and his very work creates for him obligations, inclinations, and aptitudes which will find their expression in history.

History is coming more and more to rest upon the careful investigation of social and economic facts, such as those which we have just noted in the preceding paragraph. Through this social intermediary we might already partially connect history with geography. It is in fact work and the direct consequences of work which form the true connection between geography and history.

We shall do better here to show by a few facts how far geographic investigation and explanation can throw light upon the destinies of human groups, the interests which divide them, their struggles with each other, and sometimes even the compelling motives which turn their will in a definite direction.

When traveling through Palestine one is struck by the clear meaning which certain episodes of the Gospels take on in the light of geographic environment. Christ does not find disciples in his own city, Nazareth; on the contrary, he is followed by the fishermen of Galilee. Now the inhabitants of Nazareth are patient cultivators, whose little gardens may be seen upon the slopes surrounded with walls of white stone. Like all cultivators in all countries, they are obliged to remain on the land which must be worked, and the horizon of their mind is limited to the walls which shut in their corner of the earth. They are naturally averse to new things and their very work precludes any chance of their leaving home, even though it were to follow the most winning of the leaders of men. The fishermen of the lake, on the other hand, are nomads through the very necessity of their occupation. Fishing is an irregular

business, which depends much more upon chance and is much less hostile to caprice. Then, too, there are sometimes days of exceptional catches, which permit rest and tranquillity for some time and make possible the following of a whim or the taking of a journey. We do not say that the fishermen of Galilee were fatally destined to follow Christ, but the geographical conditions of their environment and their work inclined them more than the gardeners of Nazareth to allow themselves to be led into Judea by the Galilean, and these conditions help us to a better understanding of what history tells us.

A contrast of the same sort, showing itself with entirely different intensity and over much vaster stretches, holds, as it were, the secret of a large part of the historic destinies of Asia.

Around the great mountainous mass of Tibet, stretch utterly unlike regions; to the southeast and east, the countries watered by the rainy monsoon of summer; to the north, on the contrary, desert depressions, beyond which, forming a transition between these deserts and the great forest or Siberian *taïga*, is a succession of great grassy plains forming an almost continuous strip of vegetation from Manchuria to the steppes of southern Russia and over the plains of the same type in Roumania and Hungary (see the map of the great climatic emblems of the earth, Fig. 111, pp. 244–245).

It is the monsoon which allows this multiplication of productive cultivation that characterizes India, China, and Japan. A wonderful art of cultivation has been developed in these countries, and the abundance of food substances is shown by the density of population, which, without being general or uniform, makes of this domain as a whole the home of a third of living humanity.

On the other hand, the herbaceous steppes of central Asia, where the winter is severe, do not permit of an intensive exploitation. Cultivation exists and prospers only upon the edges of the mountains, where some irrigated oases have been established. Everywhere else the natural environment is fitted in advance for pastoral life and this has been the chief region of horse-raisers, small groups of men, scattered with

their herds over an immense territory, but forced to be ever on the move, to know in advance and from a distance the available pasture grounds and the water supplies, and acquiring thus by the very necessity of their work a sense for leadership and strategy which predisposed them to the ruling of territory and the command of their fellow men.

From these steppes have come forth some of the boldest and greatest conquerors of history—Jenghiz Khan and Tamerlane—and one may say it is by these steppes, by the aptitudes conferred upon a pastoral people, by the geographical subordination to environment, that the qualities and faculties which made their power are explained.

To the question, Of these scattered herdsmen and these small cultivators swarming and crowded in all southern and eastern Asia, which are the ones that have led the world? the answer is, The former. Until the end of the eighteenth century even India was subject to the rule of the "Great Mogul," i.e., of a powerful herdsman.

Of course considerations of this sort do not explain the details of history, particular political events and individual initiative, but they form, as it were, the explanatory foundations of great historic events.

In Africa the Sudan forms the transition between the virgin forests of the Congo and the Sahara. This transition does not take place suddenly. First come the pasture lands broken by groves of trees, then the plains, where some few trees and shrubs still grow, and finally the desert (see chap. IV). The virgin forests are scarcely inhabited, for the climate is unhealthful and the luxuriant vegetation of the forest is a great obstacle to circulation and even to cultivation. The Sudan region, on the contrary, is the most thickly populated in Africa. This is the zone of the real negro political organizations which truly deserve the name of states.[1] In the Sudan are held the great markets where the products of the north and of the south are exchanged. The inhabitants of the desert bring to them salt and other products.

In Oceania the groupings made necessary by fishing have

[1]From these zones of contrast, which become the soil for the germs of states, C. Vallaux has derived his well-constructed theory of "differentiation"; see chap. VI of his *Géographie sociale, Le sol et l'état.*

given rise to political groupings, as Friedel[1] has noted. Eduard Hahn tried to show in Yemen the original center of civilization, characterized by domestication of the ox, the use of the plow, and the cultivation of cereals, basing his argument especially upon the part played by the trade in, and geographic extension of, incense throughout the East.[2]

There are, moreover, definite historical crises through which a people or a nation passes that are still more directly connected with geographical causes. What more striking case could be cited than that of Ireland—"that country ever recovering from some wound"[3]—whose history was entirely upset in the middle of the nineteenth century by very small facts whose place of action was the potato fields?

Of course one cannot explain the whole Irish crisis by potatoes alone. Other facts of a political character prepared the way for the important part played in such a case by this popular food plant. One should read the premonitory symptoms of the crisis in the excellent and very impartial book which Louis Paul Dubois has devoted to the Irish question.

While, at the end of the eighteenth century, the old penal laws which forbade Papists to buy land had been abrogated, in the first third of the nineteenth century came the "clearance systems" and a whole code of cheap eviction was voted by England. The law of 1829 took away from the small peasants the right to vote. The farm rents imposed upon them were veritable starvation rents; in short, the poverty was so great that people lived only upon potatoes. The system of the *latifundia* was so strongly developed that 744 landlords possessed more than half the surface of the ground. Besides the pasture lands which predominate in the Emerald Isle, cereals were also cultivated, but all that, plants and harvests, was hardly accessible to the peasant.

Then came the real potato disaster. During the autumn

[1]J. Friedel, Beiträge zur Kenntnis der Wirtschaftsformen der Ozeanier, *Petermanns Mitt.*, XLIX, 1903, pp. 123–126 and 269–273.

[2]See Ed. Hahn, "Die Weltstellung Yemens," *Geog. Zeitschr.*, IX, 1903, pp. 657–666. For a long time the author has been interested in this problem of the origin of the *Ackerbau*, see *Demeter und Baubo, Versuch einer Theorie der Entstehung unsres Ackerbaus*, Lüneck, 1896; and a quite recent book—a mixture of correct observations and of paleo-historic, protohistoric, or prehistoric considerations, sometimes fantastic: *Die Entstehung der Pflugkultur (Unsres Ackerbaus)*, Carl Winter, Heidelberg, 1909.

[3]E. Sainte-Marie Perrin, *Journal des débats*, October 5, 1909.

of 1845 three-fourths of the potatoes were destroyed; in 1846 and 1847 the crops were nothing at all. Thus from 1846 to 1849 the terrible famine increased. Moreover, during this time the landlords were exporting wheat, barley, oats, and live stock; and in the midst of abundance hunger raged (as we have so often seen it in India). The catastrophe was terrible because the earlier wretched state of society had made the potato the only bread of the people.

When once its proper part has been assigned to history, who can fail to see the influence of geography, a dominating influence which is being exercised even in our own time? From this land where people were dying of hunger men fled in multitudes and crossed the ocean to establish in a freer land a new Ireland, an American Ireland, which is to-day numerically superior to the old Ireland.

Emigration took away:

From 1846 to 1851	1,240,000 persons
From 1851 to 1861	1,149,000 persons
From 1861 to 1871	768,000 persons
From 1871 to 1881	618,000 persons
From 1881 to 1891	768,000 persons
From 1891 to 1901	431,000 persons
From 1901 to 1914	447,565 persons
From 1846 to 1917	5,558,713 persons

The evil and the movement are decreasing to-day, but the impulse given to a people by a potato disease attained proportions which make it a great historical fact. It is not for us to point out here all its consequences, but geography should at least point out its enormous general influence.

In 1846 the population of Ireland was 8,500,000; in 1914 it had decreased to nearly half that number (4,381,000). Even though the flood of emigration accounts for part of the population that has disappeared, what a hecatomb the calamity caused in the island!

In comparison with such a ruin what are the disasters of a cyclone or an earthquake, what the devastation in human life due to the despotic caprice of a Sudanese sultan, or even to the events of an ordinary war among civilized nations? Our minds can scarcely grasp in all its meaning the lasting influence of such an agricultural fact, and we must emphasize its historical and political import by showing in a short and

final table how the proportion of Irish population to that of the United Kingdom as a whole has been changed by this crisis.

	1801		1901	
	Total population in thousands	Number of inhabitants per square mile	Total population in thousands	Number of inhabitants per square mile
England	8,892	153	32,526	558
Scotland	1,608	54	4,472	150
Ireland	5,395	166	4,458	137

In 1801 the density of population in Ireland was greater than in England itself; a century later it was less than in Scotland, where so many upland regions are only moors and heaths in which grouse are hunted. In 1801 the population of Ireland represented 34 per cent of the total population of the entire United Kingdom; a century later it represented only 10½ per cent.

Here is another phenomenon of political geography which is still more recent, in fact contemporary. The book officially published by Norway for the Paris Exposition of 1900[1] says:

The ordinary maps of Europe which take account only of absolute distances have fostered the idea that the two countries of the peninsula form an organic whole. This is true *topographically* speaking, but it is not true from the point of view of *anthropogeography*. On the contrary, a population map of the peninsula shows, in a clear and striking manner, the existence of the wide uninhabited zone between the two countries, and that, too, even if we take into account the camps of the nomadic Laplanders of the northern plateau, and in spite of the rather late immigration of the Finns, now largely assimilated, which has to a certain extent populated the desert region of the frontier forests of the south. A map which would represent graphically the ease of communication with foreign lands would bring out still more the isolated rôle played by this almost impenetrable zone, where journeys are often possible only during a very short time each year, while communications are so easy in every direction by way of the North Sea. Toward the east, i.e., toward the land, the kingdom of Norway is, with remarkable distinctness, isolated from its neighbors; there are few countries which form an anthropogeographical whole so well isolated by nature.[2]

[1] *La Norvège*, Christiania, 1900.

[2] Note, simply as an exception that does not change the validity of the statement as a whole, that there are a number of railroads from the Baltic to the ocean (see Fig. 210).

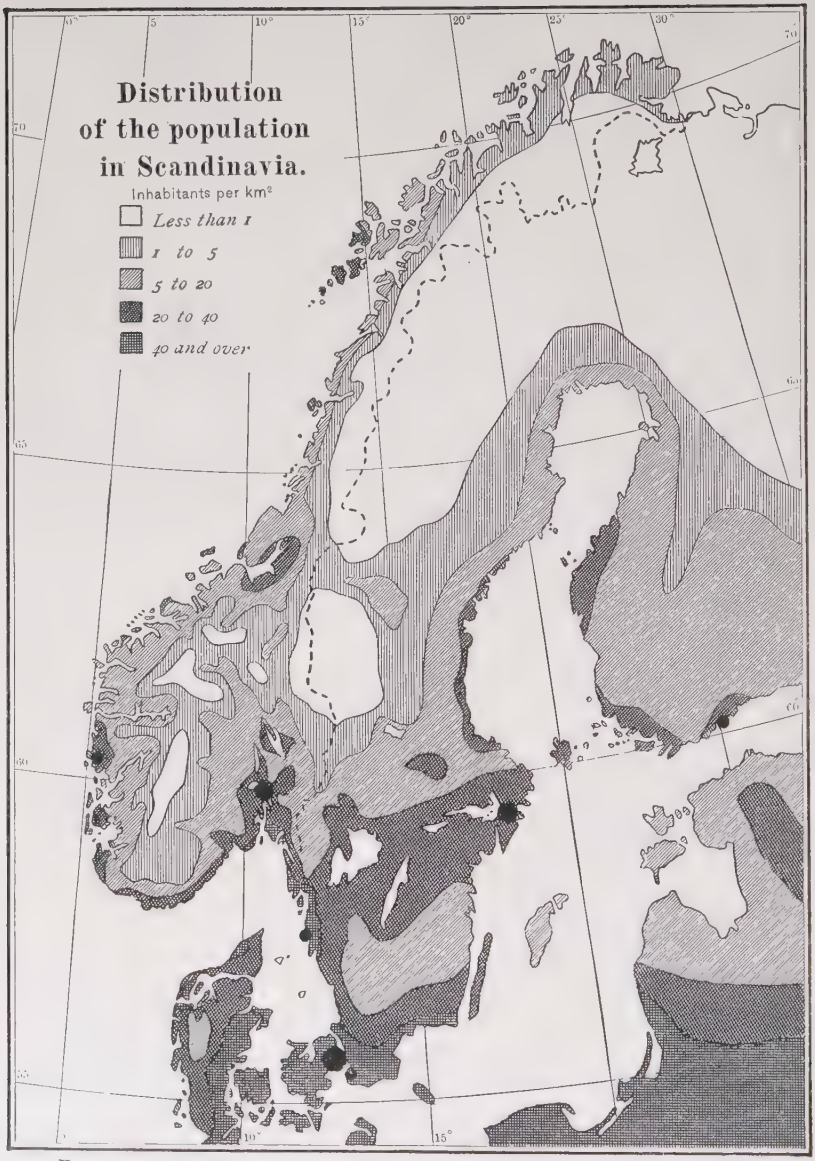

FIG. 209. THE GENERAL DISTRIBUTION OF POPULATION IN SCANDINAVIA

This map, published by Andr. M. Hansen, shows to what a degree the two kingdoms, now entirely separate, have always been separated by what is really a desert from the human point of view.

These judicious remarks are also supported by two very instructive maps, one at p. 8, reproduced here (see Fig. 209: The general distribution of population in Scandinavia); the other (still more geographical, for it localizes the facts still more exactly) at the end of the volume: *Norge*, scale 1: 3,600,000, a map of the inhabited districts, which are marked in red.

The political facts of 1905, the separation of the kingdoms of Norway and Sweden, have both illustrated and confirmed the truth expressed eighteen years ago by these statements and maps.

Some writers, exaggerating somewhat, in our opinion, have been tempted to go even farther. If we may believe them, men, with the exception of voluntary martyrs and saints, are good only so long as they have enough to eat. F. Le Play[1] did not hesitate to write:

> [In the Middle Ages and in the west of Europe] the special source of [social] peace at that epoch was the abundance of available ground and a free enjoyment of a large number of spontaneous products. So long as available ground was not lacking in a locality, the men there remained at peace, with even a fair amount of virtue. On the contrary, as soon as it was completely occupied, the men who could not be provided for had to emigrate from their native place and then, even without evil intentions, they stirred up trouble in society.[2]

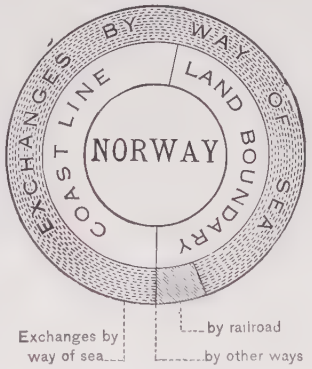

FIG. 210. THE ECONOMIC INDEPENDENCE OF NORWAY IN RELATION TO SWEDEN

The long continental frontier of Norway has little commercial value; it is by sea that nearly all exchanges are made and nearly all circulation and communication is established.

Let us stop prudently at an order of phenomena that are more circumscribed and more "measurable."

England has seen the rise of a whole "radical" representation supported by the industrial regions—that is, by the coal regions. The "imperialism" of Chamberlain was above all the imperialism of the member from Birmingham. Victor Bérard

[1] F. Le Play, *Les Ouvriers européens*, 2d edition (Tours, 1877), Vol. I, *Avant-propos*, p. vii.

[2] *Ibid.*, Vol. III, p. 348.

has sharply insisted upon this political conflict in the United Kingdom to-day in his book *L'Angleterre et l'impérialisme*.[1]

In Germany we do not find identical but analogous facts. Coal is not only revolutionary in an economic way, but as a consequence is revolutionary both historically and politically.

The facts answer: Germany will be an industrial country. . . . . For entire Germany, twelve years after the profound cause which gives the decisive impulse to this tendency of things, as Cicero calls slow and definitive revolutions, in 1882, the census by profession shows the following proportions per thousand inhabitants: 425 are occupied in agriculture, 355 in industry, 100 in commerce and transportation. Thirteen years later the census by professions of 1895 shows: 357 in agriculture, 391 in industry, 115 in commerce and transportation; that is, 506 as against 355. These figures give in a way the result of a silent popular vote. The greater part of Germany has chosen for industry, accepting implicitly the revolution which this "yes" is bringing about in the ways of toiling, sweating, thinking, feeling, willing. . . . . The development of industrial activity has been directed by the subsoil, particularly by the coal deposits. . . . .[2]

Once more, geographers must not change themselves into historians. Let them be allowed to follow the influence of human geography into the very midst of history, but let them strive never to lose sight of those "essential facts" which are the "touchstones" of true geography. If one wishes, for example, to form an idea of just how far a struggle, of which the stake is primarily the road, can give rise to the gravest political complications, one has only to follow in the light of geographical facts the whole Balkan crisis from 1906 to 1909.[3]

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[1]Armand Colin, Paris, 1900. See especially, on the subject of Birmingham — the rendezvous of dissenters, of innovators and inventors, the center of independence as opposed to tradition, the incarnation "of the material and visible interests of all, of the right of all to life and to happiness"— the first chapter, which has for a heading this sentence taken from an address by Joseph Chamberlain in 1886: "I come to you from Birmingham, that is from the city which is, above all cities, the center of aggressive radicalism, from the city which is always famous for its democratic sympathies. . . . ."

[2]Henri Moysset, *L'Esprit public en Allemagne, vingt ans après Bismarck*, Alcan, Paris, 1911, pp. 112 and 113; see the developments which follow and read all of chapter III, "Les Causes du mécontentement général."

[3]There is no better guide than René Pinon. One should read in his book *L'Europe et l'Empire ottoman*, chap. VI, "La Crise de 1908, Chemins de fer et réformes"; chap. VII, "La Rivalité des grandes puissances dans l'Empire ottoman" (Bagdad railroad); and chap. VIII, "Le Conflit anglo-turc et la question arabe" (the Tabah incident, that is, the German-Egyptian conflict for the terminus of the railroad from Mecca upon the Red Sea at the Gulf of Akaba, and the Koweit incident, that is the Anglo-Turk conflict for the terminus of the Bagdad railroad upon the Persian Gulf).

Or take the pass over which runs an easy road establishing close relations between the two slopes of a mountainous highland (very often the inhabitants of the high valleys communicate directly with the inhabitants of the high valleys on the other side of the same mountains while they are separated from the lower valleys and from the low country by gorges, defiles, "straits," which, especially before the construction of roads or railroads, were in more than one case impassable). From these communications by the high Alpine passes easy of approach there result human facts which have shown themselves in political history. The duchy of Savoy has extended its dominion over both slopes of the Alps and has long comprised the lower Valais. Is not this the historical expression of the ease of circulation and the traditional use of the two passes of the Great and Little St. Bernard? It was not without reason that St. Bernard of Menthon established his hospices upon these two roads which border the highland of Mont Blanc on the northeast and on the southwest and which enveloped it and still envelop it to-day with a veritable network of constantly moving human beings (more than 100,000 travelers cross each of these passes annually). The House of Savoy had no trouble in establishing its dominion on the other side of the Alps; from the earliest time, one may say, it was astride the Alps. Though the political incidents and vicissitudes of the contemporary period, though the prejudices with which rulers and diplomats have long been imbued and which in contradiction to geographic realities and historic facts of the past have caused to be built up a sort of diplomatic dogma about the pretended line of the watershed;[1] though finally, the boundaries between neighboring states today cut transversely the two passes of the Little and the Great St. Bernard, the long influence exerted during so many centuries by the two St. Bernards persists in showing itself by a striking fact: all the valleys which surround Mont Blanc are French in language. In spite of the generous gifts made in former

[1] See what happened in the Chilean-Argentine conflict, and read the remarkable article by L. Gallois in the *Ann. de géog.*, notably the first pages on that false political conception of the divide: "Les Andes de Patagonie," *Ann. de géog.* X, 1901, pp. 232–259. See also: Col. Sir Thomas H. Holdich, "The Countries of the King's Award," London, 1904.

times by German emperors to the hospice of the Great St. Bernard, in spite of the attempts at assimilation and the pressure so often exerted by the civil and religious authorities of the upper Valais where German is spoken, in spite of the Italian policy of to-day on the banks of the Dora Baltea, in spite of all the efforts of the past or present, the roads of the two great Alpine passes begin and end in regions where the same language is spoken. For the inhabitants of the Italian valley of Aosta and of the Swiss lower Valais speak French as do the peasants of the high Savoyard valleys. We have here an historic and linguistic whole which is in evident connection with that natural whole created by the roads[1] (see Figs. 211, 212).

If we were going back into the past and remaking all history in the light of geographical facts, it would be necessary to show the rôle played by the roads—silk roads, salt roads, spice and other roads—in the evolution of historic relations between groups of human beings.

In the matter of the influence upon population of the building of a road, no example is more characteristic than that of the Trans-Siberian Railway. The laws and the administrative traditions of Russia, which on the whole are in every way opposed to emigration, gave way before the new needs.[2]

This determining influence of the road, with all that we have called its prolongations in human geography, square or station, market or port, would show itself on a small scale as well as on a large scale. Primitive Switzerland became conscious of itself and a first union of interests was formed by the coalition of the forest cantons. Why? Because the

[1]In the work which we have already mentioned, "Des Conditions de la vie dans les hautes vallées alpestres à l'altitude de 800 mètres," *Bull. géog. de Fontenay*, January and August, 1901, Paul Girardin noted that political groups were formed in the direction of the easiest communications and natural relations. Now each of these Alpine valleys is barred or choked up toward the lower end, while at the head it broadens out into a series of basins which communicate with the valleys of the other slope by necks of pasture land containing lakes. Between these valleys, running in opposite directions but coming together near their heads, continual relations are kept up, and there is a network of roads for mule drivers. From these relations have resulted small political groups on both slopes at once. The type of these groups on both sides of the summit line, not to mention the House of Savoy, was the republic of Briançonnais, including three valleys on the French slope and three on the Piedmont slope, in all five *escartons*. In the Vaudois valleys they still speak French today. The idea of taking as a boundary the divide, or "the summit of falling waters," dates from the 18th century.

[2]See Georges Alfassa, *La Crise agraire en Russie, Quarante ans de propriété collective*, Paris, 1905, pp. 161 ff.

lake which is called the "lake of the four cantons" or Vierwaldstättersee formed the crossing of the roads, or rather the great public square of communication, of exchange, and

FIG. 211. GENERAL DIVISION OF LANGUAGES IN SWITZERLAND IN THE CENTRAL ALPS

This is only a general map for the purpose of giving an exact understanding of the map, Fig. 212, which would be located in the lower left hand corner of this map, south of the bend of the Rhone, and of course entirely within the zone of the French language.

of political connection between the three valleys of the high mountains whose streams led into this sheet of water (upper valley of the Reuss or canton of Uri, valley of the Muotta or canton of Schwyz, valley of the Aa or canton of Unterwalden, first union of the three cantons in 1291); and because this same "central station," or better this liquid confederation of little coves or small ports, led the peasants of the lower valley of the Reuss (Lucerne) to join with those of the first three cantons (1332). It was the lake which naturally bound the interests of the high mountains to those of the plateau. Here is the cradle of the Helvetian Confederation, because here is the knot between the primitive cantons and also the knot of that association of the Alps and the plateau which always

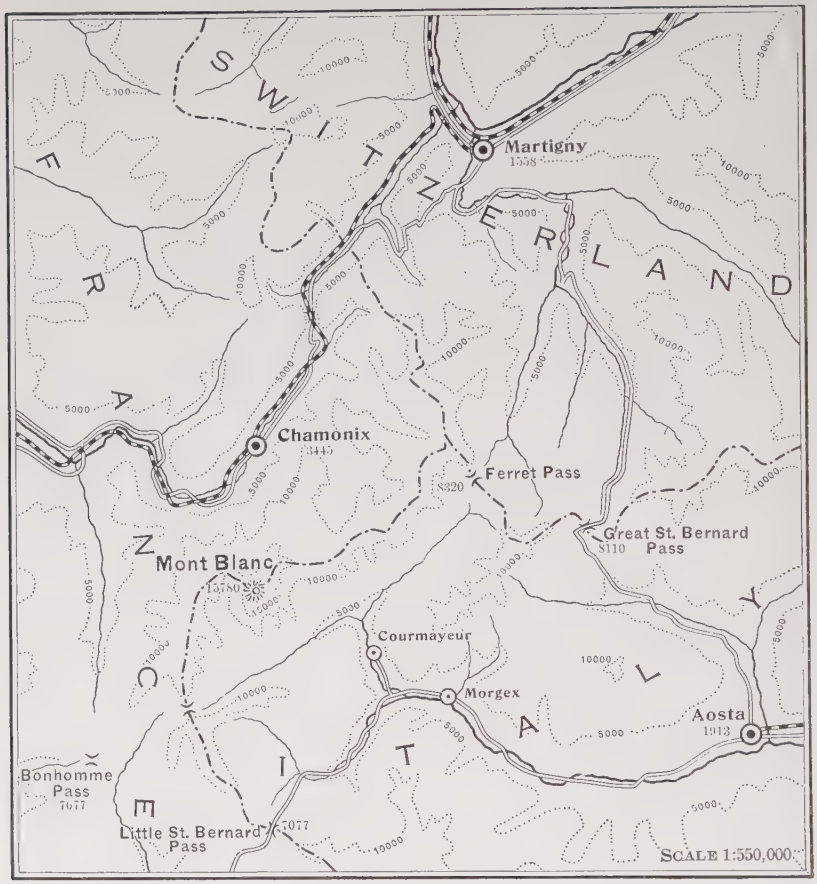


FIG. 212. THE FRENCH LANGUAGE ENVELOPS THE WHOLE OF THE MONT BLANC MASS, IN SWITZERLAND, ITALY, AND FRANCE

In spite of the situation of Mont Blanc in the midst of the Alps, in spite of its general altitude (the contour lines of 5,000 and 10,000 feet are shown), in spite of the fact that the borders of three states meet here, the two roads and the traditional communication of the two passes of Great and Little Saint Bernard have maintained in lower Valais and the Aosta valley the same language as in Savoy.

has been and still is the *raison d'être* and the strength of all Switzerland.[1]

By nature and in general the inhabitants of the high valleys of mountainous countries, when these are closed valleys, are individualists and have a tendency to live very independently

[1]The economic activity of the lake of the four cantons is still important today; see F. Becker, *Wasserstrassen zu und in der Schweiz*, Zurich, 1904, p. 6.

of each other. But in the single case of the lake of the four cantons (lake of Lucerne) the public square and the market are in the very place where in the Alps is often found the gorge or the rapids of the river which correspond to a sort of human desert.[1]

As if to bear witness to the rôle played by the lake, all the geographic sites commemorative of the first efforts and of the first successes at federation are located upon the banks or near the banks of the Vierwaldstättersee: the Grütli, Brunnen (agreement of December 9, 1315), the chapel of Tell, the depression of Stanz, so easy of approach on all sides, where the famous Diet was held, etc.[2]

If one were taking up the history of primitive Switzerland from this point of view, it would be necessary to emphasize also the rôle of the lakes which "gravitate around the lake of Lucerne," like advanced positions toward "the heart of the Confederation" which is always the lake of the four cantons, and like advanced positions for the defense of the back country. It was on the shores of Lake Aegeri that the battle of Morgarten was fought on November 16, 1315, the first victory of the Swiss over the House of Hapsburg; and it was on the shores of Lake Sempach, beyond and in front of Lucerne, upon the plateau, that Duke Leopold of Austria was defeated and perished in 1386.

Certainly the history of roads, and military history more than any other, must rest, and in fact has long rested, upon geography. It is in questions of this sort that we would find the bond indicated in Chapter III between the ways of communication and the natural or artificial facts opposed to circulation, viz., fortifications. Strongholds are connected with roads.

"Belgium, since the time of Caesar, has been the road for armies. Lens, Seneffe, Steenquerque, Neerwinden, Malplaquet, Fleurus, Jemappes, Waterloo, are all Belgian names."

[1] A representative type of this general fact is, for example, the terminal gorge of the Lonza, just where the southern entrance of the new tunnel of Lötschberg has been cut, and where, before this work began, there was a real desert of several miles separating the few inhabitants of Lötschenthal from the valley of the Rhone.

[2] For all these facts, summed up briefly and precisely, with important corrections of dates, see B. Van Muyden, "Conférences sur l'histoire de la Suisse," *La Suisse économique*, Payot, Lausanne, 1908, I, pp. 9 ff.

The famous cities which the treaties of Westphalia and of Utrecht called the "Barrier Cities" are in Belgium. "This country," adds André Tardieu, with a keen sense of reality, "if it is not a 'barrier,' becomes a passage."[1]

Many great cities have in their origin been bound to and sometimes restricted to one or more islands in a river: as the island of Lutetia for Paris, the Kölln for Berlin, the Tiberine island for Rome. Why? Because this situation upon an island in rivers which are sometimes easily navigable (Seine and Spree) and which were always more or less navigable for boats of that time (Tiber) furnished easy means of access to the settlement, and at the same time lines of defense. The same thing was true of the small island in an arm of the sea or of a lake: Copenhagen, Stockholm; and of islands properly maritime: old Syracuse, and the island of Ortygia (Figs. 213, 214, 215, 216).

Inversely, dangerous zones, defiles difficult to cross, become naturally the "place" for a road. In the high Alpine valleys a bridge is ordinarily thrown across the river where its bed is narrowest and its current swiftest. It is well known that bogs are obstacles to circulation, and that is the reason, we should say, that points of passage are frequently met with in them which, in Switzerland, for example, bear the typical names of Bruggo, Bruggen, Brieg, Brüggli, Les Ponts, Pontet, Les Marches, Les Traverses,[2] etc.

For the geographer it is of prime importance to emphasize the influence of the natural phenomena of orography or hydrography. For example, south of the lake of Garda, an ancient "tongue basin" (*Zungenbecken*) of a great glacier, is that magnificent and continuous morainic amphitheater which has been studied and represented by Th. Fischer, A. Penck, and others, and which forms a hemicycle of hills, a veritable bastion, barring the approach to the lake and shutting it in. Upon this bastion, near it and at its foot, hostile armies have many times met, and the amphitheater of glacial moraines is

[1] A. Tardieu, "Léopold II et son règne," *Rev. des deux mondes*, February 1, 1910, p. 673.

[2] J. Früh and C. Schröter, *Die Moore der Schweiz*, Bern, 1904, pp. 313–315. Read also the very intelligent memoir by Lord Curzon of Kedleston, *Frontiers*, Clarendon Press, Oxford, 1907.

FIG. 113. BABII AND GRAND OF LA CITE. A CITY OF WHICH THE PRIMITIVE NUCLEUS WAS AN ISLAND

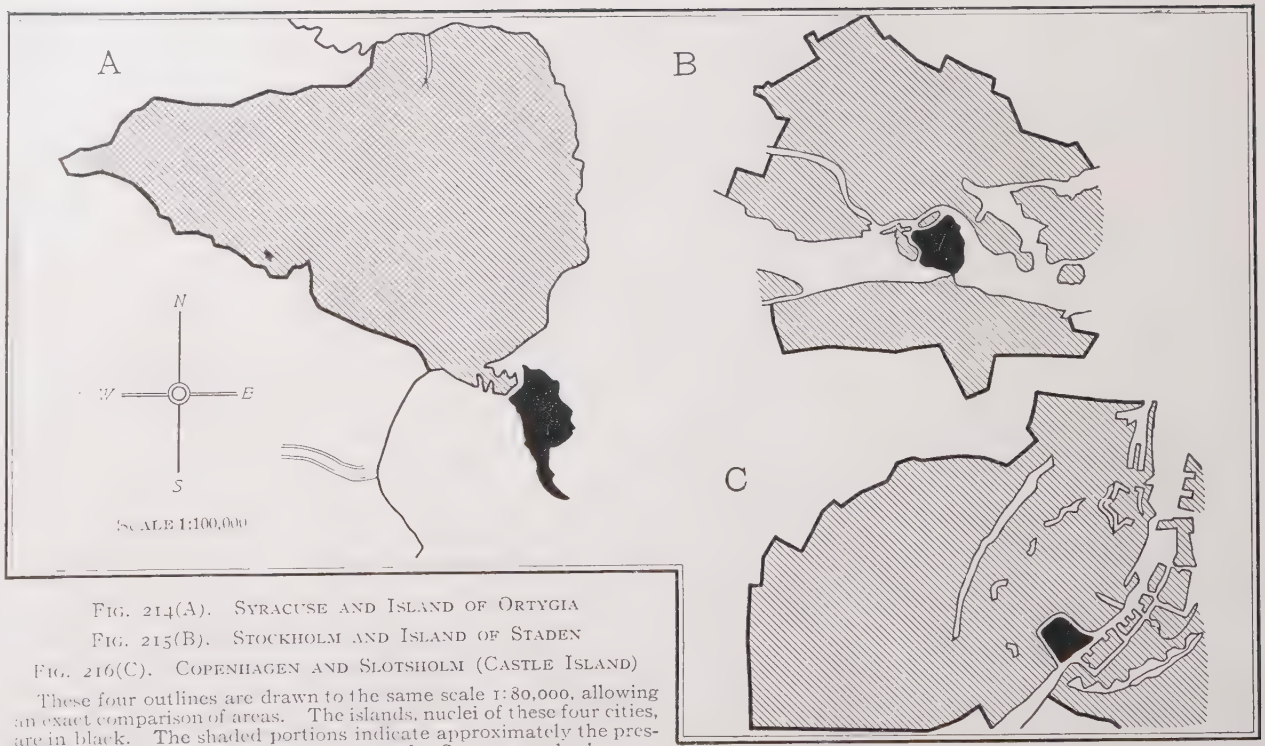


FIG. 214(A). SYRACUSE AND ISLAND OF ORTYGIA

FIG. 215(B). STOCKHOLM AND ISLAND OF STADEN

FIG. 216(C). COPENHAGEN AND SLOTSHOLM (CASTLE ISLAND)

These four outlines are drawn to the same scale 1:80,000, allowing an exact comparison of areas. The islands, nuclei of these four cities, are in black. The shaded portions indicate approximately the present urban areas. An exception is made for Syracuse only, because the present Syracuse, aside from the railroad station and a small suburb, is in the same island of Ortygia, and the shaded portion corresponds to what was formerly the great Syracuse at the time of its splendor.

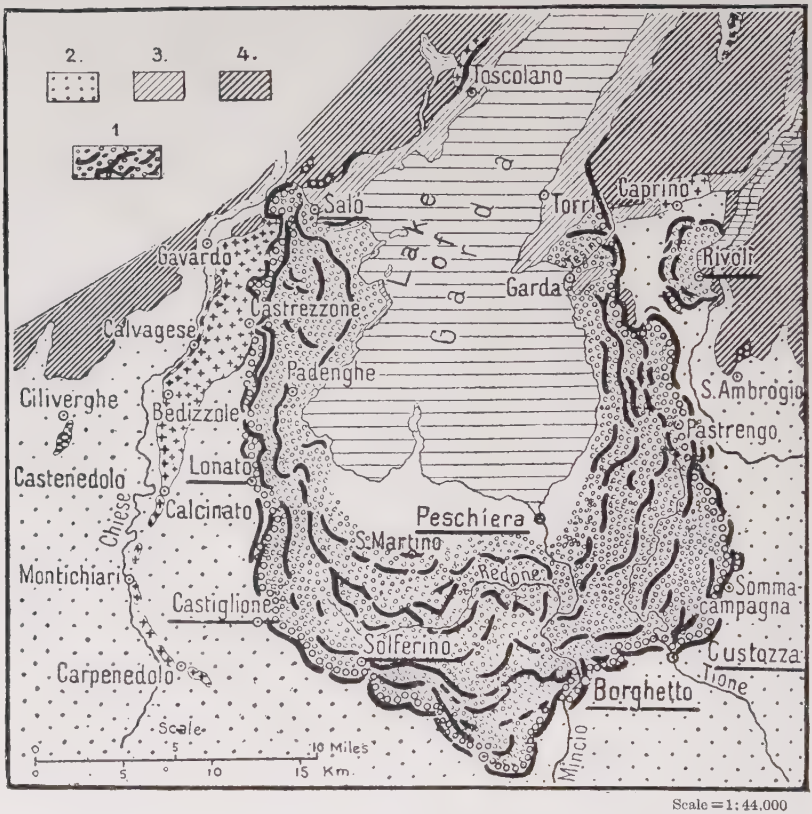
marked by a whole series of names of battles which recall and illustrate its geographic significance: Lonato, Solferino, Custozza, etc. (See map in Fig. 217.)

Military historians, such as Chuquet, have therefore made large use of geography;[1] and in a general way, as we shall see in the last chapter of this book, all history, as it has become more and more positive and realistic, has become also more geographical. We should not, however, fail to recognize the arbitrary acts of man.

Rabbits are introduced into Australia and at once a scourge is created (Chap. IV, p. 306, note 1). A vessel comes into Genoa or Marseilles and its rats bring cholera or the plague. The phylloxera invades the vineyards of Europe and, but for a prodigious effort at renewing and replanting, the long-established cultivation of vast regions would have been annihilated. Gypsy moths introduced into Massachusetts by accident have devastated trees and have been the cause of an expenditure of thousands of dollars, not in eradicating them, but in restricting their distribution. We are at the mercy of blind forces which are unthinkingly loosed by us and against which we must then struggle at the expense of our own time and strength.

More than that, the deliberate act of the sugar convention of Brussels, by suppressing all exportation bonuses after September, 1903, reduced the amount of surface planted in beets and, so to speak, ruthlessly wiped off the map of France thousands of acres of this plant. The negotiators of the treaty of Frankfurt deprived France of the productive surfaces of Alsace-Lorraine, of the revenue from taxable raw materials which swelled the budget of the former German Empire, and especially of a million and a half men of a calm temperament, laborious and energetic, whose total effort was cut off from the total effort of geographic and economic France. The arbitrary cutting up of Poland was carried out as a cruel child cuts up the body of an insect. History shows us mutilations of this

[1]Ardouin-Dumazet, through writing military history, chronicles, and geography, is directed more and more toward geography. On their part, geographers are becoming more interested in military affairs, and the *Petermanns Mitteilungen* started in 1910 a new section on military geography. As an example of good geographical criticism of a military question, see A. Demangeon, "La Trouée de l'Oise," *Ann. de géog.*, XVI, 1907, pp. 309–315.



Scale = 1:44.000

FIG. 217. MORAINIC AMPHITHEATER OF LAGO DI GARDA

1. Moraines of the last glacial period.
2. Rock fragments of the "lower terrace."
3. Portions of the mountain which were covered by the glacier.
4. Portions of the mountain which were not covered by the glacier.

It is a natural bastion, at the foot or on the sides of which the armies of all time have met and fought; all the underlined names have a military importance and recall famous deeds; Borghetto, May 28, 1876; Salò, Lonato, Castiglione, July 31 to August 5, 1796; Custozza, July 25, 1848 and June 24, 1866; Solferino, June 24, 1859.

All this recalls the battle on the edge or on the first projecting hills of this morainic system; farther to the north, in the northeast, is Rivoli, and inside the bastion is Peschiera.

The geological portion of this map is from that by A. Penck in the great work *Die Alpen im Eiszeitalter* by A. Penck and E. Brückner, vol. III, opp. p. 852.

sort or even radical destructions on a small as well as on a large scale—"evictions" and "pacifications." At the beginning of the last century the county of Sutherland, in the north

of Scotland, was deliberately depopulated. The agents of the landlords having advised the Duchess of Sutherland to give her lands over to the raising of sheep rather than to leave them in the hands of tenants who did not properly pay their rent, she followed this monstrous advice. Beginning with 1807 the inhabitants were driven out; in 1814 the famous Sellar began to set fire to the moors and even to the houses to hasten the evacuation; in 1827 "with a few exceptions the depopulation of the county was complete."[1] The inhabitants of the highlands were thus thrown upon the coast, and highlanders who detested the sea were forced to become sailors and fishermen. Here are phenomena which affect and engender forms of population and which certainly depend upon human causes.

There are, as we have said, laws which forbid henceforth the covering of houses with thatch or shingles. There are also laws which bring about the forced division of estates and the unlimited subdivisions of the portions; there are, on the other hand, other laws which order the consolidation of estates or which make the "family property" unseizable. All such legislative measures find expression in real, persistent effects upon the surface of the earth.

An ancient tenure of "communal goods," which is no longer either general or adapted to the present division of property, keeps under the collective system excellent lands and a very rich valley. Because this is the "common" field, all pass through it, all go there to dry their linen, and they even let their geese wander there (Fig. 218).

All around Paris immediately beyond the fortifications a concentric ring of land is reserved under the name of the "military zone." It is forbidden to build there; or rather, any building there may be torn down and removed at any time without indemnity. As a result of this administrative measure, a strip of territory in the midst of the Parisian agglomeration, between the thickly populated and well-built-up suburbs and the city itself, is shut off from the progress of normal building.

[1]See Charles Guernier, *Les Crofters écossais*, Paris, 1897, p. 79, and all of Book III, beginning at p. 71. See the *Gloomy Memories*, reëdited in 1883 by Mackenzie and the *Glengarry Evictions* by Donald Ross. See finally what we have noted above on the historical "preparation" of the Irish crisis.

Jean Brunhes

FIG. 218. HOW FACTS OF THE SOCIAL ORDER ARE EXPLAINED BY FACTS OF HUMAN GEOGRAPHY

At Vic-sur-Cère (Cantal), those communal grounds situated in the midst of the Cère Valley would be excellent meadows, but the collective system, now obsolete and unheeded, makes this land common to all even the geese (See p. 563).

Thus one sees at the very gates of Paris waste lands or little patches of garden dotted with queer temporary buildings made of old boards or tin boxes and resembling camps of wretched nomads[1] (see Fig. 219).

In the Dobruja, which is a vast island of refuge where subsist those motley ethnical groups studied by Eugène Pittard, the German villages have kept an "imported" look and stand out to an astonishing degree from the Slavic villages or the gypsy camps. Fidelity to custom seems increased rather than diminished by transplantation into another geographic environment.

Certain economic facts especially are increasingly susceptible of contradictions and complications which, so to speak, place them in revolt against geography. To-day it is no longer necessarily when wheat fails in a country that famines take place. There may be fine crops of wheat sold in advance to exporters, and while the exporters grow rich the peasants die of hunger. Southern Russia has offered us such an anti-geographic spectacle several times within the last quarter of a century.[2]

The increasing facility of transportation to a distance or of exportation causes, on the other hand, in certain regions, a specialization of cultivation or of animal-raising which would never have arisen before. In Brittany, in the interior part of the district of Léon, the mediocre cultivation of cereals has given place to meadows because outlets have been made for animal-raising.

Circulation is not satisfied with sending products far away to new markets; with delivering, for example, within very recent times every year into Europe from 80 to 100 million pounds (40 or 50 million kilograms) of soya, or Manchurian beans. It even exerts an influence upon phenomena of the first group and causes types of houses to exist outside of and beyond their natural setting. Thus frame houses that can be taken down and transported have become one of the characteristics

[1] In order to see to what an extent legislative or administrative measures modify the facts of human settlement on our planet, read the remarkable book by Professor Paul Masson, *Histoire du commerce français dans le Levant au XVIII^e siècle*, Hachette, Paris, 1911.

[2] See Victor Bérard, "Angleterre et Russie," *Rev. de Paris*, September 15, 1904, p. 436.

of the treeless prairies of Canada beyond the limits of the great forest. The sod house of the Great Plains is also temporary. It costs but little. If drought should come and drive

Leon

FIG. 219. HOW FACTS OF AN ADMINISTRATIVE ORDER ARE EXPLAINED BY FACTS OF HUMAN GEOGRAPHY

The military zone surrounding Paris is occupied by miserable hovels which are in general inhabited only intermittently. This is one of the best and has permanent tenants. View taken at Gentilly, near the railway station of Sceaux.

out the families, but little money would be lost on the house. If the crops were good, the sod house could in time be replaced by a better house, as has happened to a large degree.

With all the more reason all the agglomerations of houses, all villages and cities, depend, for what they may become upon that network of relations and connections which Mackinder once designated by the expressive word *nodality*.[1] Each city becomes the financial, economic and social bullseye of the area contributing directly to it. Just as the people of a rural region look to the nearest hamlet as their "city," so the smaller city finds its metropolis in the larger center.

[1] See what we have said above, p. 169.

World commerce, world circulation, *Weltverkehr*, govern in truth a very large number of facts of the three groups (cities, roads, cultivation, raising of animals, exploitation of minerals). This immense economic complex, world commerce, may be compared to a complex of physical geography, such as climate. Tempests are suddenly let loose, sowing ruin in fields of sugar cane or tin mines thousands of miles from the places where the commercial tempest raged. The peasant who sows wheat in Beauce or in Podolia no longer depends simply upon the atmosphere. His harvest, materially good or bad, will be made economically good or bad by those vicissitudes of the commercial atmosphere which we might well compare to the famous *Klimaschwankungen* (oscillations of climate). Likewise the lowering of a transportation rate may suddenly modify the economic distance between two points in space and all this happens suddenly as if, with the stroke of a pen like a magic wand, the real road were shortened or lengthened.

In short, even states in their complex and general situation are subject to the effects of fluctuations in world trade. The economic situation of a country such as Switzerland is to-day a function of *Weltverkehr* as much as of those natural geographical factors which rule the lives of the energetic inhabitants of this patch of earth. "A people is a part of the world only if it possess a market in the world."[1]

The "wheat kings" do not gather the harvests, they discount them. The "oil or copper kings" must have precise and scientific knowledge of all the present and future resources of the soil. Napoleon, who certainly was able to modify somewhat the map of Europe by his own will, wrote one day: "The policy of states is in their geography."[2] In the same way in the face of the greatly increased power of the financial oligarchies, the Napoleons of to-day, as in the face of the social plans or dreams of political parties, we may say: "Every lasting policy and all successful economic movements must be based more and more upon geography."

At the end of the present chapter devoted to parts of human

[1] Léon Hennebicq, "L'Expansion maritime," *Rev. écon. internat.*, March 15–20, 1911, p. 437.

[2] *Correspondance de Napoléon;* letter of November 10, 1804.

geography which lie "beyond the essential facts," let us note that historical or political geography rests essentially upon the consideration of localized and regional facts, while social geography, on the contrary, aims at bringing out the general influences which men undergo as a result of certain efforts and certain modes of occupation of the earth. Historical geography must always have a cantonal, provincial, national tendency. Social geography must aim at conclusions more independent of local variability.

It is in this sense that social geography shows us what must be one of the aims of human geography. We must aim at constructing some day a general human geography, founded of course upon the minute observation of thousands of localized facts but independent of regional geography to the same extent that general physical geography, which deals with principles, is independent of local or regional descriptions, which illustrate principles.

CHAPTER IX

THE GEOGRAPHIC SPIRIT

1. *The geographic spirit in the economic, social, and historical sciences.*
2. *The psychological factor in the connections between natural phenomena and human activity.*
3. *Human adaptation to geographic conditions.*

1. THE GEOGRAPHIC SPIRIT IN THE ECONOMIC, SOCIAL AND HISTORICAL SCIENCES

In what does the geographic spirit consist?

The geographer must know how to observe. Mere willingness to see is not enough. In physical as in human geography the first and not the least difficult step is learning to see the actual facts of the earth's surface as they are.[1]

The geographical method, wherever it can be used, gives first place to the exact study of what exists to-day. Before interpreting upon more or less debatable evidence the facts of the past, one endeavors, in following the geographical method, to observe, to group, and finally, if possible, to classify the facts of the present. Such a method has a truly positive and scientific character.

Let us learn the present geographic conditions, without being compelled first to study the origin and the historic transformations of phenomena. One may organize the statistics or draw up a geographical table of the present distribution of this or that plant in a given country; one is not obliged to search out what succession of plants there has been in this same region for several centuries. That, in fact, is another study corresponding to other interests.

Is it not reasonable first to examine what we ourselves see, rather than try to picture, on more or less complete and authentic evidence, what our ancestors saw? Both studies are

[1]Read Albrecht Penck, *Beobachtung als Grundlage der Geographie*, Geb. Bornträger, Berlin, 1906.

legitimate; far from excluding each other, they should complete and even confirm each other. But, if some are allowed to treat these facts from the historical point of view alone, why should we be refused the right to treat them from the geographical point of view alone? That is the extent of our claims.

Geographers must always endeavor to establish the exact locality where the phenomenon studied is produced. The question of place is all-important, and should find expression in maps or diagrams upon which would be represented two classes of facts: the points or zones where the fact appears under maximum or optimum conditions, and, on the other hand, the limit that marks the extreme range of the phenomenon.

In the beginning of this book we noted the geographic orientation of a large number of works connected with the earth sciences,[1] and we emphasized the fruitful development of botanical geography.[2] This tendency is becoming more and more general; studies are being made of the geographic distribution of thermal springs,[3] of earthquakes,[4] of rodents,[5] or the exact and cartographic distribution of oysters, mussels, etc.,[6] and better still, in a work that has the rare merit of having been produced through the close and fruitful collaboration of a geographer and a botanist, the distribution of peat-bogs,[7] etc.

[1]The earth sciences have an ever-increasing place for the principle of the geographic coördination of facts. See the fine collection of paleogeographic maps in A. de Lapparent, *Traité de géologie*, Masson, Paris; also the copious illustrations, so truly geographic, in *L'Architecture du sol de la France* by Commandant Barré, Armand Colin, Paris; and especially Haug's systematic theory of *geosynclinals*, which has *par excellence* a geographical value and importance; see also the entire synthetic work by Ed. Suess.

[2]Besides the works noted in Chapter I, see Arnold Jacobi, "Lage und Form biogeographischen Gebiete," *Zeitschr. der Ges. für Erdkunde zu Berlin*, 1900, pp. 147–238.

[3]L. de Launay, "La Distribution géographique des sources thermales," *Rev. gén. des Sciences*, July 15, 1898.

[4]Montessus de Ballore, *Géographie séismologique*, with a preface by Albert de Lapparent, Armand Colin, Paris.

[5]J. Palacky, *La Distribution géographique des rongeurs sur le globe* (*Travaux géographiques tchèques*, 5, 1903, I), V. Svambera, Prague, 1904.

[6]L. Joubin, "La Carte des mollusques comestibles des côtes de France," *Ann. de géog.*, May 15, 1908, pp. 197–204.

[7]J. Früh and C. Schröter, *Die Moore der Schweiz mit Berücksichtigung der gesamten Moorfrage* (*Beiträge zur Geologie der Schweiz*, Geotechnische Serie, III, Lieferung, Berne, 1904, 40 pages). See, for example, P. Lesne, "La Distribution géographique des *Coléoptères Bostrychides* dans ses rapports avec le régime alimentaire, Rôle probable des grandes migrations humaines," *Comptes rendus Acad. sciences*, CXXXVII, 1903, pp. 133–135, a discussion of coleoptera which inhabit dead trees; the author considers men responsible for the transplanting of these insects, even as far as the Antilles and South America. This is said to be the result of the traffic in African negroes. It is evident to what an extent these studies of botanical and zoological geography keep pace with human geography. See, also, Louis Germain, "La Distribution géographique des animaux d'après l'*Atlas* de Bartholomew," *Ann. de géog.*, XXI, 1912, pp. 20–28.

Many phenomena which have both an economic interest and a great biological interest, such as the migrations of birds, are especially considered in their relations to geographical facts.[1]

In the succeeding chapters we likewise observed how geographically important and useful it was to examine and represent the geographical distribution of the wooden house, of coal mines, of sheep-raising, of the cultivation of wheat, etc.

This same preoccupying question of place is becoming more and more dominant outside of strictly geographical circles, and particularly in agricultural circles. By the very necessity of the practical connection of their activity with climate and soil, the agronomists seem predestined to produce good geography; and they have not failed to do so. The large-scale agronomic maps of Belgium, France, Germany, Japan, etc., are models of painstaking efforts to localize human facts upon the surface of the earth.[2] One of the most elaborate of these agricultural atlases is the one forthcoming from the United States Department of Agriculture in which the geographic distributions of soils and climate and surface features, the time of seeding, planting and harvesting and crop distribution will be fully presented.

From strictly agricultural facts one passes naturally to economic facts connected with agriculture. In many countries publications dealing with these questions are accompanied by graphic representations which localize the facts: Denmark, Sweden, Norway, Germany, France,[3] etc. More complex and what we may call more human economic facts have been represented graphically. Engelbrecht has studied the localization of the prices of cereals in the United States from

[1] W. R. Eckardt, "Die geographischen Grundlagen des Vogelzugproblems," *Petermanns Mitt.*, LVI, 1910, pp. 241–245.

[2] The agronomic map is not the geologic map; but the geologic map forms an excellent foundation for agronomic studies. There are also maps showing the chemical qualities of the soil as they are revealed by analysis. Finally, agronomists such as A. Proost, the director of the Rural Office of the Department of Agriculture of Belgium, have often emphasized the special value of maps representing the physical qualities of the soil. In the *Géographie agricole de la France et du monde*, by J. Du Plessis de Grenédan, with a letter-preface by the Marquis de Vogue (Masson, Paris), may be found a great many new maps, representing facts of cultivation and of the raising of various kinds of livestock (the raising of bees and the production of honey, chicken raising, duck raising, etc.).

[3] We cannot too highly recommend and praise the economic and demographic maps contained in that splendid memorial which the Finland Geographical Society has compiled in honor of its country, *L'Atlas de Finlande*, together with the two volumes of text which accompany and comment upon it.

1862 to 1900 and has evolved a map of "isotimal" lines by connecting with a continuous curve the points where these prices are the same.[1] By joining with continuous curves the points which may be reached in the same number of hours or days from a great urban center, "isochronic" lines are obtained.

In the book *Mitteleuropa*, by Partsch, the map, Figure 27, p. 409, is a reproduction of the map of the isochrones of Berlin for the year 1900 (map by Marie Krauske) with its three zones; that of the points which may be reached within two hours or less, that of the points at a distance of from two to five hours, and finally that of points at a distance of from five to ten hours. The *Atlas of the World's Commerce*, by J. G. Bartholomew, contains an Isochronic Distance Chart for 1906 with London as a center (see Fig. 220). Finally, Max Eckert has published in *Petermanns Mitteilungen* a newer, better and more complete isochronic map of the world than any of the earlier ones, with very full information about the history of the earlier attempts and the method followed.[2]

Those who seek to localize economic facts are naturally led to examine the causes of this localization, and thus the examination of the geographical environment is introduced into political economy.[3] There is perhaps no more striking example than that of the great official censuses, particularly those of the United States and of India. In the *Twelfth Census* and the *Thirteenth Census* of the United States several studies of this kind may be found, for example that in the *Twelfth Census* by Frederick S. Hall, *Localization of Industries*, which has been analyzed by H. Hauser in the *Annales de Géographie*.[4] In grouping the causes explaining the present development of American industries under seven main heads —"Nearness of Materials," "Nearness of Markets," "Water Power," "Favorable Climates," "Abundance of Labor,"

[1]Th. Engelbrecht, *Die geographische Verteilung der Getreidepreise in der Vereinigten Staaten von 1862 bis 1900*, Parey, Berlin, 1903. Maps of places where the harvest is gathered on the same date or in the same period should be studied, like those which R. Blanchard (*La Flandre*, Armand Colin, Paris, 1906, p. 20) and Captain J. Levainville (*Le Morvan*, Armand Colin, Paris, 1900) have prepared for the wheat harvest.

[2]Max Eckert, "Eine neue Isochronenkarte der Erde," *Petermanns Mitt.*, LV, 1909, pp. 209–216, etc.

[3]See P. Clerget, "Le Milieu géographique en économie politique," *Rev. écon. de Bordeaux*, XVII, 1907, pp. 304 ff.

[4]XII, 1903, pp. 193–206.

"Capital," "Advance Due to an Earlier Impulse"—Hall is interested first of all in economic questions, but at the same time he is producing human geography.[1]

In applying what might be called critical geography to sociological studies, one could and should take up a considerable number of abstract theories formulated in the eighteenth and nineteenth centuries and show their lack of real foundation. Neither the theory of Sumner Maine of collective property as a primitive form of property[2] nor Ricardo's theory of "diminishing returns" could stand the test of being brought face to face with the facts of positive human geography.

Human geography (writes an economist in the *Revue d'économie politique*)[3] is destined to renew all the sociological theories that speculate about some sort of abstract man. For example, the study of the different forms of ownership of water here examined does away with all *a priori* and absolute theories, those that lay down as a dogma that individual property is the only form of property acceptable to human reason and those that tend to a conception of state ownership as applicable to all the countries of the earth.[4]

It is interesting to analyze closely these conclusions and compare them with the present teachings of political economy.

Human geography, or at least the study of natural conditions, their action upon the work of man and man's reaction upon them, has already renovated more than one sociological theory. It was this study, however summary, that led Paul Leroy-Beaulieu[5] to take up the theories of the English economists, Malthus and Ricardo, and refute their pessimistic exaggerations.

The earlier English school of economists (wrote the great liberal economist), with all its great merits, from Adam Smith down to but not including John Stuart Mill, made the mistake of neglecting nature; this neglect had serious consequences, notably an exaggerated pessimism.

Considering nature only under one form, *land*, in the narrow sense of the word, this school contented itself with establishing, by a too absolute or premature generalization, the gradual diminishing of the increase in productive power of the land relative to the successive expenditures of capital and labor.

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[1] See von Halle, "Die Verteilung der Industrie auf die klimatischen Zonen," *Verh. des VII. Internat. Geographen-Kongresses Berlin, 1899*, Berlin, II, pp. 514–528. Well-made censuses, small or large, tend more and more toward human geography; see, for example, Stephen Bauer, *Die Bevölkerung des Kantons Basel-Stadt am 1 Dec., 1900*, Basel, 1905.

[2] Cf. A. Métin, *L'Inde d'aujourd'hui*, pp. 234 ff.

[3] See Georges Gariel, "Le Problème économique de l'irrigation d'après un livre récent," *Rev. d'écon. politique*, 1903, pp. 802–826.

[4] Jean Brunhes, *L'Irrigation*, etc., p. 439, "Portée critique de la géographie humaine."

[5] See his *Essai sur la répartition des richesses*, Guillaumin, Paris, 1897, 4th edition.

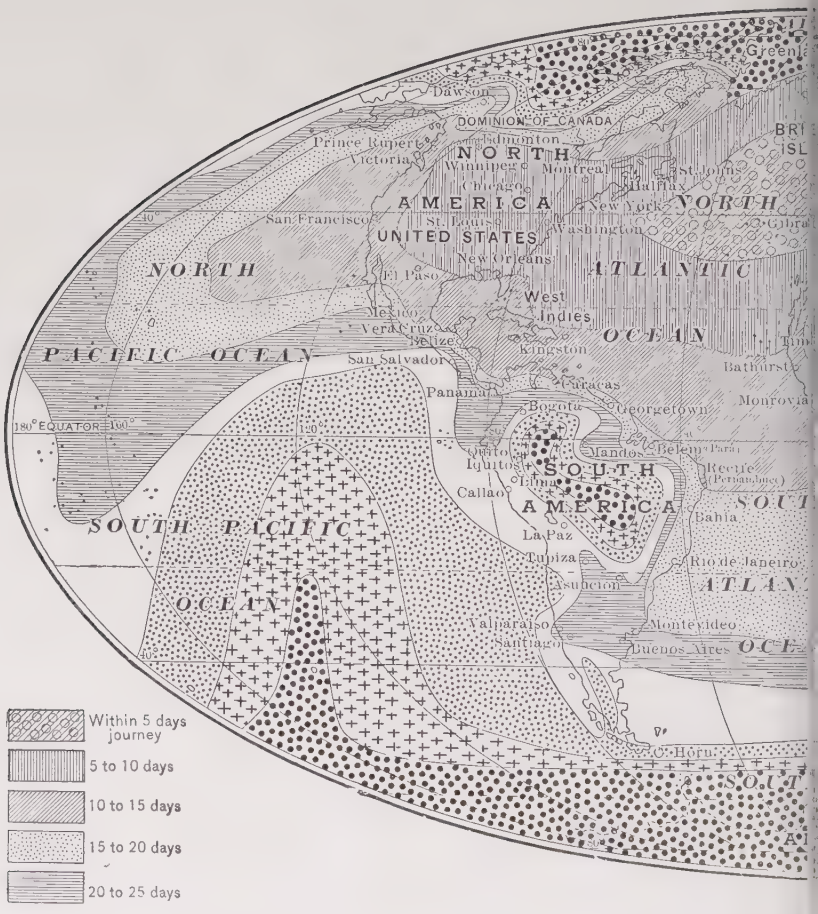
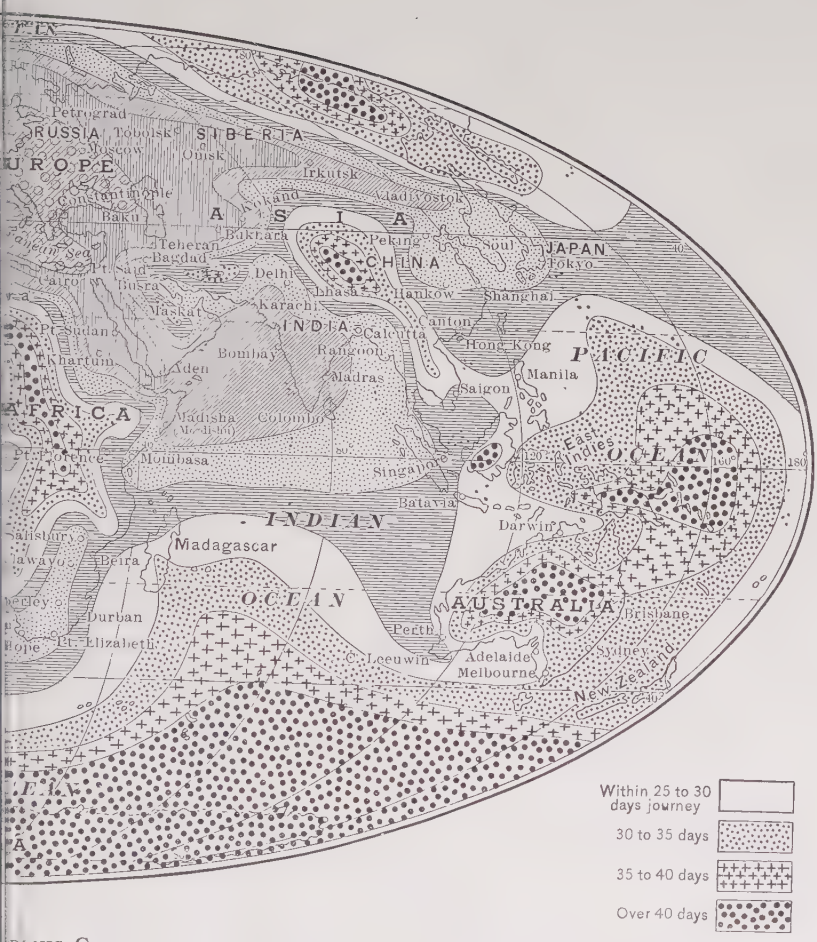


FIG. 220. A T

After the Isochronic Chart with London as the center, Bacon's Library and from five to forty days and over, traveling from London.



RONIC CHART

ouse Chart of the World, showing the distances that may be traversed within

The economic pessimism of Ricardo, Malthus, and John Stuart Mill comes in large part from the fact that the circumstances of the time when they lived and their habits of thought did not lead them to study as a whole the rôle of external nature, the different resources it keeps in store for us, the half-revealed forces and those that are still almost unsuspected that it will be able to place at our disposal.[1]

The rôle of human geography is not to build up social theories but to show the impossibility or inexactness of certain *a priori* and too abstract systems. This is not a negligible rôle, and many recent works on political economy have a particular value because of this geographical study preceding their moral, sociological, or financial observations and judgments.

Thus a study of poverty should mean not simply statistics but an attempt at precise localization. Since to fix the topographical distribution of poverty is a means of knowing it more exactly, it is doubtless also a means of relieving and curing it in a less abstract and more efficacious manner.

We see this in a book on New York by Jacob Riis and in the study by Henri Bonnet on the Map of the Poor in Paris, published in the *Revue des deux mondes*, September 15, 1906.

Poverty is not necessarily disease, but it has many relations with it, and disease itself, especially contagious or epidemic disease, is a social poverty.

There is likewise a geography of diseases.[2] The discoveries of the last quarter of a century make this clear. Why? Because there is certainly a geography of the insects, acaridans, rodents, etc., which transmit such diseases as malaria, yellow fever, or cholera. The connection between the natural environment and man is established through a small living being which must itself first be studied. The first stage of research seems to be the geographical investigation and, if possible, the graphic representation of the zones where a certain disease is prevalent. A beginning has been made. The connection between marshy regions and malaria has been shown by means of typical maps (see

[1]Paul Leroy-Beaulieu, *Traité théorique et pratique d'économie politique*, Guillaumin, Paris, pp. 125–126.

[2]F. G. Clemow, *The Geography of Disease* (Cambridge Geographical Series), Cambridge, England.

the map reproduced in Theobald Fischer's *Penisola Italiana*, p. 365).[1]

Studies of the sleeping sickness began rightly with a study of the region where the scourge is prevalent.[2] It appeared that there was a certain correspondence between the parts of Africa where this disease appears and the parts where the tsetse fly is found. Investigation was then begun to find what could be the responsibility of the tsetse, or more exactly of its near relatives.[3]

There, of course, geography stops. Let us add, however, that, for the study of the biological conditions of invertebrates, scholars who occupy themselves with the lower beings living upon the earth or in the air have much to learn from the studies of the biological environment carried on in reference to the small inhabitants of the sea in laboratories of maritime zoölogy such as that of Woods Hole and Rostoff, of oceanography such as that of Monaco, or of maritime fishing such as that of Bergen.

The medicine of to-day has been entirely renovated by hygiene. What is hygiene but putting trust in the natural forces of the human organism and in the action of natural agents? Hygiene means air, water, sunlight, etc. Hygiene, then, means geography. Moreover, studies of social hygiene can be fruitful only in so far as they rest upon an exact knowledge of the general physical conditions.[4]

[1] *Mortalità per infezione malarica in ciascun Comune del regno d'Italia nei tre anni, 1890-91-92.* See also in Karl Andree's *Geographie des Welthandels*, edited by Franz Heiderich and Robert Sieger, H. Keller, Frankfort, 1909, the general map "Geographische Verbreitung einiger Krankheiten," I, p. 256; the general distribution of eight great maladies is shown. Prince Auguste d'Arenberg presented at the Paris meeting of the *Institut Colonial international* (1908) a remarkable report summing up the results of the struggle against swamp fever, yellow fever, and the sleeping sickness.

[2] The Society of Geography of Paris took under its patronage the delegation that went to the Congo to study the sleeping sickness, from 1906 to 1908; in 1909 it assisted in the publication of the *Rapport de la mission d'études de la maladie du sommeil au Congo français.*

[3] See A. Laveran and F. Mesnil, *Trypanosomes et Trypanosomiases*, Masson, Paris, 1904, and the article which Maurice Caullery has devoted to this work (*Ann. de géog.*, XIII, 1904, pp. 457–461). Dr. J. Brault, "Les Trois Grandes Pandémies des pays chauds; leur distribution géographique, leurs principaux foyers," *Archives générales de médecine*, 88th year, 1908, Vol. 199, pp. 465–493; "Paludisme et maladies parapaludéennes, leur distribution géographique aux colonies et dans les pays chauds," *Rev. scientifique*, March 28, 1898, pp. 394–402 and world map.

[4] The book by Dr. Bonmariage on Russia is a model, and is accompanied by excellent maps, clearly drawn by Jean Bertrand: *La Russie d'Europe, topographie, relief, géologie, hydrologie, climatologie, régions naturelles. Les Peuples et leur mode de répartition, Essai d'hygiène générale*, Brussels and Paris, 1903. In this connection, see Dr. G. Merveilleux, "Ile de la Réunion," *Ann. d'hygiène et de médecine coloniale*, VI, 1903, pp. 195–259 and figure. *Étude de géographie médicale de l'île de la Réunion*, Saint-Denis, 1902. Also Paul Juillerat, *Rapport à M. le Préfet de la Seine sur les recherches effectuées au Bureau du Casier sanitaire pendant l'année 1908*, Imp. Chaix, Paris, 1909.

Like the economic and demographic sciences, the whole group of philological, ethnical, and historical sciences, in the widest sense, is becoming more and more impregnated with the geographical spirit.

Researches bearing upon human facts, such as languages, proper names, legends, etc., had been remodeled and often set right by the historical spirit, that is, by the spirit which considers the succession of forms in time and their evolutionary development. To this fruitful point of view a new inspiration has been added, which is growing in influence.

As the Salzburg historian, August Prinzinger, has well said, "The name [the geographic name] is like the mountain and the valley, like the river, the forest, and the flora, like uses and customs, a part of *Heimat;* fashion does not change it like a coat."[1] It is, so to speak, fastened to a point of space. To represent the distribution of certain village names, the distribution of certain endings (*ingen*, *ens*, etc., *loo* in Holland, etc.) (see Fig. 221), the distribution even of changes in pronunciation of the same word (for example, the Arab name for mountain: *Gebel* in Egypt, *Jebel* in the Algerian and Tunisian Sahara, and *Jdebel* elsewhere), is to throw light at once upon all the problems of historical philology which arise from these different facts. Similarly maps of saints' names are made up, and the names which have come from plants or forms of the land are examined in the light of geography. One is then naturally led to form a clear idea of the actual dispersion of all the archaeological facts, of ruins, as well as of legends and folklore.[2]

Place names may be considered either from the point of view of a linguistic origin, as going back to the Ligurians, the Iberians, the Celts, the Romans, etc. (and they then allow us to reconstruct the extension and the habitat of these primitive peoples, a means which does not give absolute certainty, but which is up to the present time the only means we have), or from the point of view of their meaning, which often refers to a physical circumstance, that is, to a geographical fact.

[1]Quoted in Raimund Friedrich Kaindl, *Die Volkskunde, ihre Bedeutung, ihre Ziele und ihre Methode,* (Max. Klar's collection, *Die Erdkunde,* XVII. Teil), Deuticke, Leipzig and Vienna, 1903, p. 65.

[2]See E. de Martonne, *La Valachie*, pp. 384 ff.

A place name may be considered a document, just as a fossil, a medal, or a coin are documents.[1]

The names of saints, to which we have just referred, have been catalogued in the *Dictionnaire géographique de la France* by Joanne. Some are accompanied by sketches (twelve in all), showing their zones of dispersion. There are no fewer than 4,450 communes which bear saints' names, filling 340 pages of this quarto dictionary (Vol. VI, Q.-S. D.). Among the most widespread are Saint-André (73 communes), Saint-Aubin (73), Saint-Étienne (70), Saint-Georges (77), Saint-Germain (127), Saint-Hilaire (80), Saint-Jean (171), Saint-Julien (91), Saint-Laurent (94), Saint-Martin (224), Saint-Michel (63), Saint-Pierre (162). The number would be still larger if we added the sometimes queer designations which represent the local deformations of Saints' names, sometimes hardly recognizable: Saint-Père and Saint-Pé (for Saint-Pierre), Saint Blin, Saint Broing, and Saint-Bérain (for Saint-Bénigne), Saint-Sernin, Saint-Sorlin (for Saint-Saturnin). Who would recognize the name of Saint-Hilaire in the mountain of "Alaric"? And who would think of the names frequent in the east of France where Saint and Sainte are replaced by

[1]See first the classic book by Egli, *Nomina geographica.* See some special studies, such as H. Dehérain, "La Toponymie de la Colonie du Cap de Bonne-Espérance au XVIII[e] siècle," *La Géographie*, IV, 1901, pp. 162 ff.; Levainville, "La Toponymie morvandelle," *ibid*, XVIII, 1908, pp. 23–32, etc. Also the *Atlas linguistique de la France*, by J. Gilliéron and E. Edmont, and give special notice to L. Berthoud and L. Matruchot, *Étude historique et étymologique des noms de lieux habités (villes, villages et principaux hameaux) du département de la Côte-d'Or:* I, *Période anté-romaine;* II, *Période gallo-romaine* (in 2 parts) which appeared in *Bull. Soc. sci. hist. et nat. de Semur*, 1902 and 1905, and separately, impr. V. Berdot, Semur, 1901 (115 pages), 1902 (238 pages), 1905 (170 pages). A. Longnon has offered at the Collège de France a course in historical geography which has given birth to some fine works on toponomy, among which that by L. Berthoud and L. Matruchot stands in the first rank. The method followed consists in applying one's self to the most ancient forms which are known, those previous to the year 1,000 being the most valuable, as they have, in general, kept almost the primitive theme. Moreover, one is aided in this research by comparison with certain analogous words belonging to the same toponomical family. Such are certain words having the same ending, *-dunum*, *-durum*, *-briga*, *-ingen*, and *-ens* (see above, Fig. 221). Brochure I comprises the ante-Roman period, that is, the names presumably of Iberian, Ligurian, Celtic, or Gallic origin, meaning by "name of such and such an origin" names derived from the language of those peoples which have remained in the current language for a longer or shorter period after the disappearance of those peoples. For the Gallic-Roman period (Brochures II and III), the problem consists in getting back to the most probable theme by making use of forms more and more ancient. This theme, often conjectural, is formed on a *gentilice*, derived from a *cognomen;* for example, *Champagny*, derived from the theme *Campaniacus*, formed on the gentilice *campanius*, derived from the cognomen *Campanus*, "inhabitant of the country." Finally, von Ettmayer has summed up well the method and the bearing of the researches on names of places at the 50th Congress of German philologists (1909): "Ziele und Methode des Ortsnamenforschung," *Germanisch-Romanische Monatschrift*, II, February, 1910, pp. 138–140.

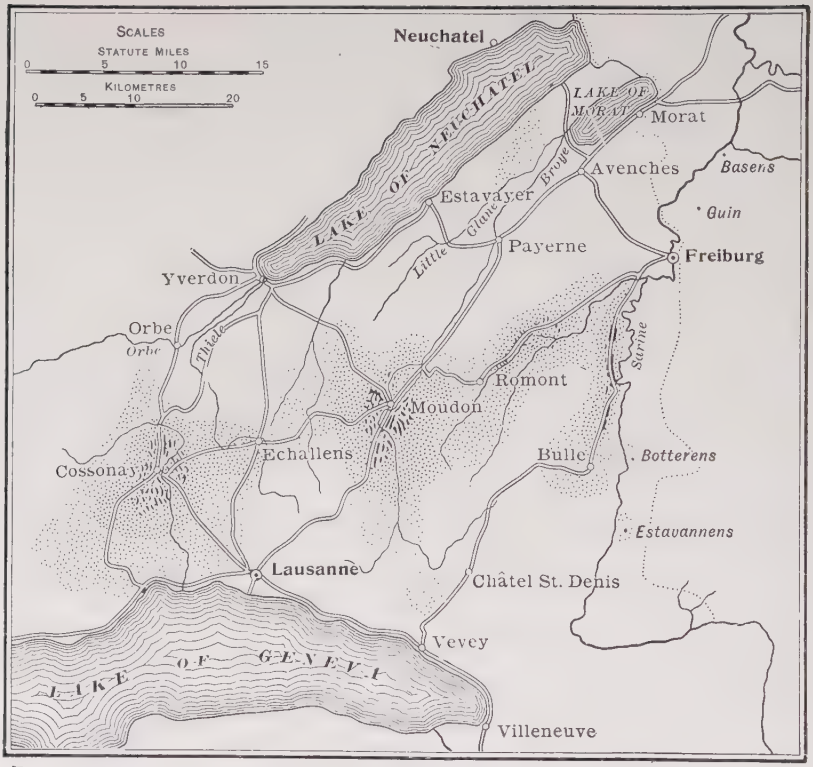


FIG. 221. PRINCIPAL REGIONS OF GEOGRAPHIC DISTRIBUTION OF PLACE NAMES WITH TERMINATION "ENS" OR "INGES" IN THE ROMANSH DISTRICT

It is a question of the terminations *ens* or *inges*, corresponding in Romansh to the Germanic terminations *ing* and *ingen*. The present limit of the German and French languages is shown by a light, dotted line. This is the comment of Jean Stadelmann, from whom the elements of this map are borrowed, on his scheme of distribution:

"The sketch represents a part of Roman Helvetia at the epoch of the invasion of the Germans, with the principal roads, cities and market-towns. To the *vice* known by the inscriptions in Peutinger's itinerary and table, we add Payerne, situated at the confluence of the great roads of *Eburodunum* (Yverdon) and *Aventicum* (Avenches). The great number of the German names is found in the ancient *pagus Valdensis*, which includes not only the present Vaud country, but also the southwestern part of the Freiburg territory. Minnodunum (Moudon) forms the center of an extended and very dense group of German settlements. From there the region stretches in a wide strip across the districts of Echallens and Cossonay and finally narrows between the Jura and Lake Leman. East of Moudon, these names descend, on one side, toward the south and stop at the Vevey plateau, more than five miles above Lake Leman; on the other side, they ascend to the junction of the Sarine and the Glane, extending along the two banks of the Glane and the west side of the Sarine (in the Ogoz country). Between these two rivers, the succession of Germanic settlements extends about Mont Gibloux like a belt. A little colony, very far from the center, is on the back and the southern prolongation of Mont Vuilly, between the lakes of Neuchâtel and Morat. It seems to extend also beyond the Broye, on the northern bank of the Lake of Neuchâtel. No name in *ens* in the environs of the Helvetian capital, *Aventicum*, none in the whole country traversed by the Great Roman road, from Payerne to the Lake of Morat." "*Études de toponymie romande. Pays fribourgeois et districts vaudois d'Avenches et de Payerne*, Freiburg, 1902, pp. 381 and 382; see also, pp. 382–383, the conclusions drawn from this geographic distribution.

Dom (Dompierre, Dombasle), and by Donne or Danne (Dannemarie)? Even the pagans are sanctified and the peasants who climb Mount Auxois at the time of the pilgrimage of Alise-Sainte-Reine say that they are going "toward Saint-Jetorix."

The extension of each of these saints' names is not proportional to its place in the Catholic hierarchy, but to the part played in the history of France by the province, the city, the abbey, the chapel, of which the saint is the patron. The propagation of the most widespread name, Saint-Martin, allows us to follow the steps of the conversion of pagan Gaul to Christianity; he has remained the most popular of all the saints and the *chappe* in which his relics were kept caused the word "chapelle" to be given by analogy to all reliquaries and then to the buildings themselves. Saint-Denis happened to be the patron of the abbey where the kings of France were buried. As France, at first a simple district, then a province, became the whole kingdom, his name spread to the Alps (Mont-Denis in Maurienne); his statue rose in the square of Lans-le-Bourg, and perhaps Mount Cenis was consecrated to him as Mons Sancti Dyonisii. The extension of the name of Saint-Bénigne corresponds to the power of Burgundy and did not pass beyond the limits of that province, because Burgundy did not overcome France. Brittany is the type of province with local saints, Saint-Renan for example, unknown to the rest of France; but each province, from the north to the south, had its protectors, sometimes with disconcerting names, which are borne or were borne some years ago by many children in the province, and these children could be recognized almost by that fact alone. The fortune of Saint-Lazare, especially after the Crusades, comes from the frightful disease which it devolved upon him to cure, and the change in meaning in the present word *ladre* (Saint-Lazare or Saint-Ladre), now that there are no more lepers, is not the least curious of such changes. Finally the power of certain abbeys, Saint-Antoine in the Dauphiné, Saint-Bénigne of Dijon, Saint-Benoit, was measured by the number of localities which looked for protection to this saint, and the name of the village which grew up became a sort of flag marking this moral sovereignty.

Further, in a report on topography, Paul Girardin has said:

A place name is both appropriate and expressive; it gives a picture.[1] Here are some applications of this idea, for part of Savoy, bearing upon rather different facts. In the upper Maurienne and in the upper Tarentaise, for example, the names of trees and plant species are very different, which shows the comparative rarity of communication by way of Mount Iseran; on the contrary, they are often alike for the French slope and the Italian slope (*brange*, meaning larch, etc.). Another fact connected with the forest: the *arselle* (diminutive *arsellin*) is found in the same region at a constant altitude of between 6,800 and 7,200 feet (2,100 and 2,200 meters) and designates the part of the pasture lands obtained by clearing away the preëxisting forest. This series of names marks an almost even curve and enables us to trace approximately the ancient upper limit of the forest, which is moreover still reached to-day at some isolated points (Val d'Isère).

Châtelard (French Switzerland, *châtelet*) is the Savoyard form of the diminutive of *château*, which is derived from Latin *castrum* (*castellum*, *castellarium*). It defended the ancient road of the valley, and the distribution of the different *châtelards* allows us to reconstruct the ancient roads. The *châtelard* usually crowns a ridge of rock in an isolated and hilly region. The word refers to the presence of the fortress which becomes, from the human point of view, the important fact. If the ridge was not occupied in the interests of defense, it takes the generic name of *molard* (diminutive of *mole*, related to *moles*, e.g., *Moleson*), a term which refers only to the topographical character of the ridge which rises like an island in the middle of the glacial valley (German *Inselberg*). Bessans was formerly, by reason of its fairs, the center of attraction of the upper Maurienne. Now the name of the locality is found marking the passes which lead to it: the *Bessanèse*, coming from Italy; the passes of *Bezin* (*Bezan* is the ancient form of Bessans) designating the system of passes coming from the Tarentaise by the valley of the Fours.

It is evident that these few typical remarks go beyond the field of philology and have a very great geographical interest. It is rare that the presence of a useful plant species or of a mineral is not revealed by a place name. We learn to read maps from the point of view of the figuration of the land; we should learn to read them also from the point of view of the nomenclature and its meaning, and the first condition is to demand that the topographer note down such information on the spot, note it faithfully, and note it all.[2]

[1]See in J. W. Nagel, *Geographische Namenkunde* (Max. Klar's collection *Die Erdkunde*), Deuticke, Leipzig and Vienna, 1903, a curious chapter on the geographical names of topographical origin, pp. 72 ff.

[2]Paul Girardin, in *Compte rendu de la séance du 8 janvier 1908* of the Commission de Topographie du Club Alpin français, pp. 4 and 5. See H. Jaccard, "Les Noms de végétaux dans les noms de lieux de la Suisse française," *Bull. de la Murithienne* (Sion) XXXII, 1903, pp. 109–172.

Through the following of all these human traces step by step over the land, light has been thrown upon different questions, which the method of economic or political history or of the history of art[1] or of the history of literature had been or would have been powerless to solve alone. G. Schnürer has shown that the worship of a female saint with a beard, Saint Kümmerniss, was nothing else than the transformation of the worship of the "Saint Voult" of Lucca (a representation of a Christ with robes which was in the cathedral of Lucca). The venerated image was met with in Germany, Switzerland, England, and France at points upon the roads frequented by the traveling merchants of Lucca,[2] an obvious geographical connection.

Joseph Bédier has explained the formation and evolution of the *chansons de geste* by connecting them with itineraries. The *chansons de geste* are most often in contradiction to history, but they form groups which are comprehensible and connected as soon as one has taken the trouble to localize them geographically. A certain group, that of William of Orange, is nothing else than the practical and utilitarian guide and at the same time the sincere epic echo of certain facts of human geography — the traditional pilgrimages that were strung along the Via Tolosana and of which the distant goal was Saint-James of Compostella.[3]

[1]Émile Bertaux, *L'Art dans l'Italie méridionale, de la fin de l'empire romain à la conquête de Charles d'Anjou*, Fontemoing, Paris, 1903; see especially pp. 18 and 19 and see also, from the geographical point of view, a discussion which deals with the question of *trulli*, pp. 386–399 (and above, pp. 96–97).

[2]See G. Schnürer, "Der Kultus des Volto Santo und der heiligen Wilgefortis in Freiburg," *Freiburger Geschichtsblätter*, IX, 1902; "Die Kümmernis-und Volto-Santo-Bilder in der Schweiz," *ibid.*, X, 1903; "Die Kümmernisbilder," *Jahresbericht des Neisser Kunst und Altertums-Vereins*, VII, 1904.

[3]J. Bédier, *Les Légendes épiques, Recherches sur la formation des chansons de geste*, H. Champion, Paris, 2 vols. We make haste to say that we are not competent to judge of material like this; but we cannot conceal the striking impression of truth which we gain from such discoveries. Some people are skeptical or flatly contradictory. That is not surprising. Those who first introduced the method of historical evolution in social or judiciary studies, for example, have had to overcome the same hesitation and opposition. It seems to us, even, that the facts which we purposely gather together, and which result from methods of research which are different and even far distant, reinforce each other. We are convinced that, on the day when philologists, archaeologists, historians, etc., shall regard with a clearer consciousness our "six essential facts" of human geography, they will perceive new connections and affiliations. André Chaumeix has shown very clearly to the great public the interest of the researches of J. Bédier ("Les Chansons de geste," *Rev. des deux mondes*, June 15, 1909, pp. 766–795). We note that Joseph Bédier has written a chapter of exact geographical criticism on "Chateaubriand en Amérique, vérité et fiction" in *Études critiques*, Armand Colin, Paris, 1903, pp. 125–294.

Finally Victor Bérard, by traveling over the insular and peninsular shores of the Mediterranean, with the Homeric poems in his hand, and by comparing the ancient descriptions with the nautical instructions of the Marine Hydrographical Service, has shown the exactness of these descriptions and has interpreted the *Odyssey* as a sort of voyage of investigation.

This example shows remarkably well the general orientation that we are pointing out. Following G. Hirschfeld,[1] Victor Bérard wishes to create a new word to designate the science of sites and which should be the rational explanation of human establishments; he proposes to call this science *topology*.[2] He compares the work that consists in discovering what the Mediterranean world was before written history and consequently before the Hellenic civilization, with the work of the geologist: "The history of the Mediterranean may be compared with a sedimentary land where, layer by layer, successive seas have left their traces."[3] "All the islands of the Archipelago, all the cantons of Hellas, present to us some site of an *old city* anterior to the Hellenes and left behind by the Hellenes."[4] It is because the author has conceived his entire study in accordance with this geographic vision that he reconstructs partially, with the help of Homer, the life of the Phoenician Mediterranean and gives to the Homeric poems this revolutionary, and entirely unexpected meaning: "It is a geographical document. It is the poetic but not untrue painting of a certain Mediterranean with its habits of navigation, its theories of naval life, its language, its nautical instructions, and its commerce."[5]

Such are the conclusions to which the geographic spirit may lead. More often it has only a negative value, eliminating from problems of origin solutions too narrow or in fact too theoretical, as we have said that it eliminated certain mistaken

[1] *Topologie griechischer Ansiedlungen*, Berlin, 1884.

[2] Victor Bérard, *Les Phéniciens et l'Odyssée*, 2 fine volumes very well illustrated with the aid of beautiful photographs by Madame V. Bérard, Armand Colin, Paris, 1902 and 1903, Vol. I, p. 6. See F. E. Matthes, "Topology, Topography and Topometry," *Bull. Am. Geog. Soc.*, XLIV, 1912, pp. 334–339.

[3] Victor Bérard, *Les Phéniciens et l'Odyssée*, I, p. 26.

[4] *Ibid.*, I, p. 51.

[5] *Ibid.*, I, p. 52. See also II, p. 544; and the very just observations on the marine character—not terrestrial—of the nomenclature and of the description, II, p. 554.

sociological systems; and this critical work is in itself very helpful. Without formulating arguments which beg the question, many historians have allowed themselves to be led to conclusions which seem strictly logical but which vanish upon a free geographical examination. Thus Bérard cites this remark of Renan in order to refute it: "Extensive navigation did not begin until the ninth or tenth century before our era, among the Greeks, among the present peoples or their direct ancestors. *For there are races which have an antipathy to colonization and navigation.*"[1]

Likewise, expressions such as "Mussulman habitations" are expressions which have no real meaning.[2] Excellent scholars have yielded to the temptation to simplify too much the development of human facts without taking sufficient account of the varied series of adaptations to different geographical environments. O. Montelius claims that the evolution of European habitations has passed through the series of the following forms: (1) the round or almost round conical tent, placed upon a basis of wood and covered with skins of animals, fabrics, etc.; (2) the similar round structure made entirely of wood; (3) the round structure with a conical roof resting upon a round part; (4) the round form of the wall is transformed into an oval or polygonal or tetragonal form (roof with four slopes, if the house is square); (5) the small sides of the roof become shorter; (6) the short walls rise to the rafters and the roof has two slopes.[3] In spite of the authority of Montelius, we cannot admit such a generalization any more than we can admit after all that we have noted in Chapter III any hierarchy in the types of the house which would cause the stone house to be regarded as more advanced in civilization than the house of earth or the house of wood; it simply belongs to another geographical environment.

The house is not only a geographical fact, but also an historical fact. A. Grund, in his *Veränderungen der Topographie im Wiener Walde und Wiener Becken* (Leipzig, 1901), even claims

[1]Victor Berard, *Les Phéniciens et l'Odyssée*, I, p. 14.

[2]Ch. Garnier and A. Ammann, *L'Habitation humaine.*

[3]O. Montelius, "Zur ältesten Geschichte des Wohnhauses in Europa, speciell im Norden," *Archiv. für Anthropologie*, XXIII, 1895, pp. 451–465. See also the article by E. Bertaux of which we have already spoken (*Ann. de géog.*, 1899, p. 222).

that types of houses are among the most important evidences of the history of early colonization. But that is not a sufficient reason for looking upon them exclusively as documents of ethnical origin, value, and significance. August Meitzen has made a specialty of the study of human establishments and has particularly considered the facts of agglomeration or dispersion of habitations. His three main volumes, based upon a great many observations and many plans or maps, and accompanied by an atlas, form a very important collection of documents.[1] But his theory is too systematic and it encounters contradictions of a geographical character. Let us allow a very well-informed economist and skilled observer, Georges Blondel, to soften down the theses of Meitzen by a geographical argument:

It is necessary also to take great account, much more than Meitzen does, of economic considerations which in certain parts of northern Germany overcome all others. Even to-day, in spite of the progress of agricultural chemistry, we find vast stretches in which the only inhabitable spaces are little valleys where the inhabitants must be grouped together; the rest of the country is too sterile. Thus in the valley of the Ems, and particularly in the very characteristic region that is called the Hummling, grouping in villages is inevitable. On the other hand, where the country does not permit transportation for any distance, the inhabitants were necessarily led to place their habitations near the cultivated lands.

In mountainous regions the geographical arrangement of the country has usually decided the distribution of dwellings. Thus there is a great contrast between the Bavarian plateau, which forms, as it were, the northern glacis of the Great Alps, and the high valleys which open upon it. Upon the plateau, particularly to the east of Munich, the inhabitants live for the most part in separated dwellings. Thus the 62 communes of the district of Wasserburg upon the Inn comprise 1,439 centers of habitation (*Ortschaften*). Each commune is composed generally of a main center, which bears the name of the commune and comprises a score of houses, and of a variable number of *Höfe* or isolated estates of great importance. Certain communes have as many as 50 houses. Their average extent may be estimated at 60 or 70 acres (25 or 30 hectares).

In the valleys, on the contrary, situated somewhat more to the south, but inhabited by populations of the same race, concentration has taken place. There are of course chalets and peasants' houses scattered over the mountain, but the very disposition of the places

[1] A. Meitzen, *Siedelung und Agrarwesen der Ostgermanen, der Kelten, Römer, Finnen, und Slawen*, Hertz, Berlin, 1895 (atlas of 125 maps or drawings).

has caused concentration on the borders of the rivers and the great majority of inhabitants dwell in villages grouped together.[1]

Let us pass rapidly over other categories of human facts. Linguistic or ethnical geography is forcing itself more and more not only upon those who study the problem of languages (Zimmerli, Gallois),[2] or of races (Ripley,[3] André Lefèvre,[4] Dominian[5]), from the purely scientific point of view, but also upon all those who make a point of method and who bring to the discussion of questions of the day a practical and enlightened mind (René Henry).[6] Even the history of philosophy (Janet) and the history of religions or of religious customs (P. D. Chantepie de la Saussaye) are showing increasing interest in the careful consideration of the geographic extension of facts.

Cannibalism, which is a method of hunting animal food, appears to us in many cases as a largely religious vestige of earlier traditions and customs. It is none the less true that cannibalism arose, developed, persisted chiefly, and persists still, where geographical conditions placed or place at man's disposal a very small amount of animal food, or, where conditions of isolation upon a territory small in extent and

[1]Georges Blondel, "Remarques sur le mode d'établissement des Celtes et des Germains dans l'Europe occidentale," *Entre Camarades*, Alcan, Paris, 1901, pp. 13–32. See also André Mater, "L'Origine des villages," *Rev. du mois*, March, 1908, pp. 272–290, and the detailed scientific criticism of the over-simplified system of Meitzen in J. Flach, *L'Origine historique de l'habitation et des lieux habités en France*, pp. 7 ff.; and farther on: "I have proved the simultaneous existence of villages and of estates farmed by *métayage* in Celtic, Gallo-Roman, and Frankish Gaul, and have shown the development which took place in the cities under the Latin dominion. . . . [p. 38]. Under the influences of disorder and internal strife, under the influences of the new régime as well, the population continued to cement its union during the Frankish epoch. . . . . [p. 40]," etc. What really monstrous mistakes have been made because people have interpreted as facts of race certain divergencies of customs and of life which are to be laid to the account of geography! Apropos of Tuat and Timbuktu, E. F. Gautier, the explorer of the Sahara, instances facts and makes note of conclusions particularly striking (*La Géographie*, January 15, 1906, p. 18).

[2]L. Gallois, "Les Limites linguistiques du français d'après les travaux récents," *Ann. de géog.*, IX, 1900, pp. 211–218, Pls. III–VIII.

[3]On the subject of races, one cannot praise too highly the geographic orientation of the remarkable work by William Z. Ripley on the races of Europe: *A Sociological Study*, London, 1900, with numerous maps and figures and a bibliographical index of 160 pages of all the works and articles that deal with the races of Europe. All through it maps of ethnographical distribution and even hypsometrical maps accompany the text. On p. 599, he reproduces the interesting "Carte des races de l'Europe," by J. Deniker, on the scale of 1: 30,000,000.

[4]André Lefèvre, *Germains et Slaves, origines et croyances*, Schleicher Brothers, Paris, 1903 (*Bibl. d'hist. et de géog. universelle, XII*); ancient history and folklore studied geographically with many maps.

[5]Leon Dominian, *The Frontiers of Language and Nationality in Europe*, Henry Holt & Co, New York, 1917.

[6]*La Suisse et la question des langues*, Paris and Berne, 1907, with map.

poor in resources led human beings to limit the increase in population. These facts must be studied in relation with geographical facts—as Richard Andree attempted thirty years ago[1]—but never *in abstracto*.

To fix the domain of the different civilizations as one fixes the domain of the *trulli*, or that of slate roofs, or of a certain plant, seems to be to-day the condition *sine qua non* of every synthesis relating to origins.

We come at last to history, properly so called. It is becoming, we have said, more and more geographical. Not only, following the example of Michelet and profiting by all the progress in studies of this kind, is every large work of history preceded by a geographical "preface," such as the *Tableau Géographique de la France* by Vidal de la Blache at the beginning of Lavisse's *Histoire de France*, or Bryce's Introduction to the English translation of Helmholt's *History of the World;* not only for a long time has every historical work of high quality begun with an excellent geographical picture, such as the *Mithridate* by Theodore Reinach or the *Empire des Tzars* by Anatole Leroy-Beaulieu;[2] but an attempt is being made to explain, in the full sense of the word, history by geography. It is no longer a question of a few typical facts, such as those which were given as examples of an application of the method in Chapter VIII, but it is a question of a systematic tendency, such as is seen in Miss Semple's *American History and Its Geographic Conditions*. In this book the whole history of the colonization and expansion of the United States is based upon the influence of the great facts of physical geography—the navigable rivers, mountains, and deserts.[3]

In all that field which has to do with colonization and emigration recent writers are showing themselves more and

[1]Richard Andrée, "Die Verbreitung der Anthropophagie," *Mitt. des Vereins für Erdk. zu Leipzig*, 1874, 67 pages, with a very interesting world map in two colors; the darker color is found in Australia, in New Guinea, in the Congo, and in certain parts of the Upper Amazon. Compare with this figuration, already out of date, that of the actual distribution of cannibalism on Map 2, outside the text, of E. Friedrich's *Wirtschaftsgeographie;* slight indications only in Australia, New Guinea and Borneo; the single important zone is that of the Congo.

[2]Along with Anatole Leroy-Beaulieu; *L'Empire des Tzars*, Hachette, Paris, 3d edition, 1897, see the works of Maxime Kovalewsky and especially *La Russie à la fin du XIX^e siècle*, Guillaumin, Paris, 1900.

[3]Houghton Mifflin Co., Boston and New York, 1903.

more disposed to give up theoretic systematizing and to become observers of the reality of human geography.[1]

Special historical problems, such as those which concern cities, frontiers, etc., problems which also touch human geography and which therefore have already been approached in this book, have very naturally led historians toward geography.[2] As E. Clouzot has well said, "The geographic idea has made recruits even among historians."[3]

But geography can boast of still more decisive conquests and can claim great contemporary historical works, masterpieces as partially dependent upon her.

Camille Jullian began the first volume of his *Histoire de la Gaule*[4] with a chapter called "Structure of Gaul," in which he skillfully draws a general geographical picture "after the manner and with the same expressions employed by Greek and Roman geographers in characterizing the visible structure of the soil of Gaul." The two volumes of the *Histoire de la Gaule* are filled with considerations and data which are really human geography.[5]

[1]See René Gonnard, *L'Émigration européenne au XIX^e siècle*, A. Colin, Paris, 1906; Jacques Rambaud, "L'Émigration italienne," *Rev. de Paris*, June 1, 1905, pp. 601–622, and June 15, pp. 871–894, and *Rev. de géog. annuelle*, III, 1909; Jules Saurin, *Le Peuplement français en Tunisie*, Augustin Challamel, Paris, 1910. See also certain chapters in Henri Dehérain, *L'Expansion des Boers au XIX^e siècle*, Hachette, Paris, 1905; and the vivid pages devoted to Macedonian emigration by René Pinon, *L'Europe et l'empire ottoman*, Perrin, Paris, 1908, pp. 224–231. This tendency shows clearly even in good general works: Paul Leroy-Beaulieu, *De la Colonisation chez les peuples modernes*, 6th edition, revised and considerably enlarged, Alcan, Paris, 1908, 2 vols.; Arthur Girault, *Principes de colonisation et de législation coloniale*, 2d edition, Larose, Paris, 1904, 2 vols. Too often colonization has not been exempt from mistakes or wrongdoing, just because positive observation has been neglected. See, for example, G. Grandidier, "Europeéns et Malgaches, leurs rélations aux siècles passés," *La Géographie*, XVIII, 1908, pp. 1–22. The study of the causes and actual circumstances of certain facts of emigration are touched upon in Chapter VI of the present volume, in connection with the Suf and the Mzab. Finally, note the general map in A. Woeikof's "Einwanderung und Auswanderung," *Petermanns Mitt.*, LII, 1906, Table 20.

[2]In like spirit there has been published (1914) a remarkable account of the rise and status of nomadism: *The Asiatic Background: The Cambridge Mediaeval History*, Vol. I (1911), Chap. XII, pp. 323–359.

[3]Article already quoted: "Le Problème de la formation des villes," *La Géographie*, XX, 1909, p. 166. Works of this type are those by Pirenne, by Rietschel, by Luchaire, etc., and those by Flach, whom we have had occasion to quote more than once. See also, besides the studies mentioned in paragraph 5 of Chapter III, Paul Girardin, "Rôle des conditions topographiques dans le développement des villes suisses," which appeared in Vol. II of the *Compte rendu du IX^e Congrès international de géographie*, Geneva, 1908; and "Fribourg et son site géographique," *Bull. de la Soc. neuchâtcloise de géographie*, XX, 1909–1910. See also Erwin Hauslik on cities and frontiers, *Kultur-geographie der deutschen-slawischen Sprachgrenze* (*Vierteljahrschrift für Social- und Wirtschaftsgeschichte*, VIII, Parts 1, 2, 3, 1910, with two summarizing maps, pp. 472, 473. See also studies by Gradmann and Scharfetter mentioned in note, p. 246.

[4]I, *Les Invasions gauloises et la colonisation grecque*, Hachette, Paris, 1909.

[5]See II, *Routes et villes*, pp. 222–225.

Adolf Harnack has both analyzed and synthetized, as no one had done before him, the geographical conditions and peculiarities of the diffusion of Christianity in the first centuries. From the first chapter of the first volume, devoted to what we might call the geography of Judaism, to the maps which end the second volume, and especially throughout this second volume, the spirit of the work appears happily dominated by the thought of the geographic distribution and localization of religious facts upon the surrounding shores of the Mediterranean and even in the somewhat more distant regions of the West.[1]

The work that from this point of view seems to us the most important, the most original and the newest, and at the same time the most conscious in its method, is that of Guglielmo Ferrero. Ferrero's history is connected with geography in so far as political history is constantly connected with economic history. Through this we reach the basis of actual work and material interests upon which Roman society and the Roman world were built, and through this work and these interests we grasp the relations with the conditions of physical and geographical environment. The conquest of Gaul is not merely a political conquest. It is the annexation of mines and forests to the life of the growing Empire; it is especially the introduction of a crowd of small artisans who know how to spin and weave flax, work iron, etc. The geographic resources of the conquered country are here considered, through the activity of the men who take advantage of them, as determining factors of the whole historic evolution. We see the relation which exists between this profound conception of history and the general conception of human geography.

At the time of his journey to America, in 1908, Ferrero gave a lecture upon "Wine in the History of Rome," which is very representative of his manner.

At the beginning of their history and for long centuries the Romans were water drinkers. Little wine was made in Italy and that was of

[1]Adolf Harnack, *Die Mission und Ausbreitung des Christentums in den ersten drei Jahrhunderten*, Hinrichs, Leipzig; see especially the two following maps: "Die Verbreitung des Christentums bis zum Jahre 180," and "Die Verbreitung des Christentums um das Jahr 325"; see also George Adam Smith, *The Historical Geography of the Holy Land*; Ellsworth Huntington, *Palestine and its Transformation*, Houghton Mifflin Co., Boston and New York, 1911.

poor quality. (Only the rich drank Greek wines from time to time.) By a law of correlation, as the Roman Empire spreads in the Mediterranean world, the vine spreads in Italy . . . and the connection between these two phenomena—the progress of the conquest and the progress of the vine—is not fortuitous, but organic, essential, intimate. As the policy of expansion broadens, wealth and culture increase in Rome, and as a natural consequence the traditional spirit of simplicity grows weaker, luxury increases, the desire for pleasures and even the taste for intoxicating drinks become more widespread. . . . From that time (from 130 or 120 B.C.) for a century and a half the progress of the vine continues uninterrupted, and an attempt is made to put Italian wines on a level with Greek wines. . . . We may say that the vineyards were one of the foundations of imperial authority in Italy. . . ." Ferrero makes a comparison between the invasion of Hannibal toward the end of the third century, which lasts for seventeen years and is supported with considerable patience, and the revolt of Spartacus, which was in itself less serious than the fear of the bourgeois peasants who had grown rich made them think it. And Ferrero explains this difference by the changes in the field and the garden. In the time of Hannibal they consisted of cereals and pasture lands; in the time of Spartacus they consisted of vineyards and olive groves, of long and patient cultivation, which, when once destroyed, are reconstituted only after several years of long and costly effort. Spartacus was a sort of phylloxera or olive tree fly. . . . Little by little the emperor became a sort of tutelary deity of the vineyards and the olive trees, or, in other terms, of the fortune of Italy. . . . The owners of the vineyards and the olive trees, to whom their property was dearer than the great republican traditions, placed the image of the emperor in the midst of their household gods and venerated it as they had before venerated the Senate.

What is there new in this way of treating history except looking at and seeing on the surface of the earth the reality and the variations of all we have called the essential facts of human geography? Here we may certainly evoke that "geographical sense" which Ratzel declares more and more indispensable to "observers of politico-geographical phenomena." There is a "geographical sense" which demands a more realistic perception of all the manifestations of human activity, economic, historical, and political.[1]

To see the precise forms of terrestrial reality, to see them in all their material extension and even in their limit-zones,

[1]Again, Ratzel rightly says: "Practical statesmen have always had that geographical sense that also characterizes entire peoples." A statesman like Roosevelt seems to have been very fully endowed with this sense.

to see distinctly their different representations, their different points in space—that is what the geographic spirit leads us to do.

In the presence of different types of living beings, or of manners of being, or of manifestations of human activity, the historic spirit inclines us naturally to establish a connection of succession and coördination in time—a point of view which is not only very legitimate but which has shown itself to be very intelligent and to which we owe very many discoveries in the history of to-day. The historic spirit, by inquiring everywhere into the evolution of facts, institutions, and ideas through the ages, has besides enriched all moral, political, and social sciences. Now, as we have seen, the geographic spirit is coming in its turn. It proceeds from the fundamental idea of the simultaneous juxtaposition in space of distinct types. These types do not necessarily succeed each other, but may be contemporaneous, each corresponding to a different geographical environment. Let us hail this beneficent and fruitful invasion of the geographical spirit and wish it in its turn, and all that is connected with the field of the sciences of man, a fruitful and renovating influence such as the historic spirit has exercised for a quarter of a century.

2. THE PSYCHOLOGICAL FACTOR IN THE CONNECTION BETWEEN NATURAL PHENOMENA AND HUMAN ACTIVITY

This habit of seeing realities where they are and as they are has the effect upon the mind of inspiring it with a proper distrust of simple labels and of giving it a critical sense for the variable value of geographical realities. The high mountain seems to mean in principle the exclusion of all human life. But to generalize this idea is to fall into an evident error, for in certain latitudes, in certain climates, the high regions are the most inhabited (Mexico, plateau of the Andes, etc.). Even in European countries the high mountain must be regarded from the point of view of human geography as a natural region inhabited and exploited in its own way. The word "river" will call up very different ideas according as we consider the equatorial regions where, as a result of the abundance of rains and vegetation, the river and the banks form

an almost indistinguishable whole; or the boreal regions, Canadian or Siberian, where the river is frozen, so that it ceases to exist for more than half the year; or, finally, the rivers of western Europe, which have really a fixed bed and stable banks, upon which men may establish themselves permanently. He who compares cities and villages of the same population must *see* the different realities which may correspond to these same words, the way in which the former are peopled and built, scattered or close together, placed like Calcutta in the midst of an overpopulated zone, or surrounded like Pekin with the empty environment of a steppe.

Such a spirit, at the same time positive and critical, should be especially employed when we go beyond simple and strict observation and try to explain facts or, more exactly, to connect them with each other.

Between the facts of the physical order there are sometimes relations of causality; between facts of human geography there are usually only relations of connection. To force, so to speak, the bond which connects phenomena with each other is scientifically false; and there will be great need of the spirit of criticism which will enable one to see clearly the many cases where connection is accidental and not causal.

The chief aim of this present volume is to illustrate, in a positive way, cases of connection between the physical environment and human activity. The reader will remember with what insistence we said in the paragraph on coal: Coal has existed where we find it to-day since the beginning of history, but it was as if nonexistent for men so long as they did not have the knowledge, power, or will to take advantage of it. It was psychological human facts which determined all the geographical connections of human activity with coal deposits, and which gave birth to so many phenomena before unknown.

Let the reader take up again the several chapters herein; let him re-read the examples analyzed in the sections on "Social Geography" and "Historical and Political Geography" at the end of chap. VIII; let him turn back to the conclusion of chap. VI, devoted to the oases of the Suf and of the Mzab. To these typical examples of a perfect cultivation obtained in unfavorable environments by an admirable exertion of human

will, not only in spite of these hostile conditions, but almost in proportion to the difficulties to be conquered, let us add this new example, a curious incident of social geography complementary to the notes devoted to the Balearic Islands.[1]

In a remote corner of the mountainous coast formed by the shore-fringe of the great western sierra of the island of Majorca, the very modest cultivators of the two small villages, Estallenchs-Bañalbufar, have accomplished and are still accomplishing the miraculous feat of developing the irrigated gardens of their *huertas*, and they keep them in a state of splendor that makes them appear like masterpieces, even in comparison with the other cultivated lands of this great island garden.

Estallenchs spreads out the branching patches of its olive, almond and lemon gardens between the sea and the fine highland of the Galatzo. Bañalbufar concentrates upon a still narrower space the mosaic of its admirable rising terraces. All about is a rich suburb of olive groves rising in tiers. Nearer the village are the very small, irregular and harmonious basins of a sort of great mythological fountain, such as we see upon some old Gobelin tapestries; but each basin is filled to the brim with earth which is weeded, turned, broken, smoothed, and as fresh as would be that of a jar which has just been filled. It is meant for vegetables, cereals, and here at Bañalbufar, chiefly for grapevines.

When one looks from above at all this landscape with its different levels, one sees on the upper levels two or three of these basins, which are well filled with water. They are true water-tight reservoirs of masonry, which the cultivators build at common expense and from which they distribute the water according to the strict rules of a collective organism.

In Majorca the people know how to employ irrigation wherever it is possible. The fields and the orchards are often furrowed with ditches; the *norias* (draw-wells) are numerous, and at certain points toward the center of the island, in the neighborhood of Puebla, are seen the ugly metal windmills, which are more and more taking the place of the too primitive *norias*. But nowhere does the need of water demand such

[1]See above, Chapter VIII, pp. 490–513.

careful and such expensive work as in the little region of Estallenchs-Bañalbufar. The water which is brought to the handsome reservoirs, as well as that which is parsimoniously drawn off for the needs of each little piece of land, is often conducted in channels of masonry, which are attached to the rock walls of the valley side.

Now it is here, in the rocky Sierra of the west, where the productive land can consist only of islands amid the sterile outcrops and perched above the cliffs, that the inhabitants, shut off from contact with other localities and situated close to the sea, have become at the same time fishermen and cultivators, an exceptional fact in Majorca and the Balearic Islands.[1] Between the two villages and the two ports of Estallenchs-Bañalbufar, there is more intimate connection than anywhere else. The same hands find the time to use the oars, to handle the sails, to cast the nets, and to care for the little furrows of the terraces. The more this double life demands in the way of exertion, the more these exertions seem carefully applied and fruitful. Once more, as we have shown in other environments, we find that the social demands of a more absorbing existence, combined with the material demands of a more minute and difficult agricultural conquest, give to human labor an extraordinary perfection.

Still to keep within the limits of this very human Mediterranean, here is another striking example of the power that men may acquire to discipline nature to their own ends:

> Do you know any less hospitable regions in the Mediterranean than the little corner of the Syrian shore where are situated the ports of Tyre and Sidon, famous in antiquity? It will be difficult to find any. The situations are unfavorable in themselves, and very often a heavy swell from the open sea makes it difficult to enter or leave the port. There is nothing here of nature's manifest indulgence for the Greeks, oversupplied with the advantage of a shore line deeply indented and furnished with a ragged fringe of islands. And yet the Phœnicians were a people of navigators and colonists. Why? Because their commercial ingenuity made up for the unkindness of nature, because they wished at any price to be the middlemen of the commerce of the great empires of western Asia and of Egypt with the distant countries of Spain, Gaul, and the British Isles.[2]

[1] See above, p. 504.

[2] Marcel Dubois, *La Crise maritime*, p. 25.

Thus arises a complication which sometimes makes it very difficult to determine exactly the bond that exists between men and nature. This connecting bond is in fact variable, because it rests upon man's need, upon spontaneous or deliberate appetite, and because these psychological elements, being by nature variable, necessarily cause the relation between man and the earth to vary.

We now reach a new class of complications, which result from the succession in time of different phenomena upon the same space.[1] The geographical environment remains the same, but the men who live in this environment have needs which constantly grow, becoming modified and more complicated.

Roskilde, the old capital of Denmark, for example, was already situated near the water, on the island of Zeeland, at the extremity of a long fjord which penetrates the country from the north. That was a situation excellently suited to defense, but too far away, too hidden, for the control of the sea. In the fifteenth century, Copenhagen, being preferred by King Christopher, gained the upper hand through its incomparable situation near the great "highway" of the Sound,

[1]H. Hauser has very clearly brought out this succession of the facts of human geography in an article in the *Rev. du mois* (February 10, 1906, pp. 201–213), the whole of which should be read: "La Géographie humaine et l'histoire économique." Vidal de la Blache also says in his *France*: "It is especially a political conception that makes the difference between the Roman road system and the monarchical road system of the end of the eighteenth century. Let us examine it: The roads that lead directly from the Rhone toward the Ocean, from the Saône toward the Netherlands, seem to have been twisted from their normal course. They are diverted toward Paris, where they knot and weave a sort of spider web about it. Like the tentacles of a group of polyps, they stretch out in every direction. The gap between them increases with the distance from the capital; it becomes enormous toward the west and south. To the south of the Loire, there are only two roads connecting the valley of the Rhone with the Ocean — one by way of Clermont, the other by way of Toulouse. Certain fundamental lines have not entirely disappeared. One can still find, through Langres, Chaumont, and Rheims, one of the direct roads connecting Burgundy with Flanders. But these routes of former times have ceased to be so strongly marked in the general physiognomy of the road system. A weight thrown into the balance has disturbed, for us, the equilibrium of geographic causes. Natural affinities have been exaggerated. It is no longer pure geography but a bit of history which is revealed in this concentrated organism, doubled back on itself, jealously eager to lead back to a home and to concentrate there the life scattered over the wide stretch of the country. A more self-centered individuality has succeeded to that expressed in the former road system" (pp. 380–381). The author arrives at this conclusion, which expresses at once the advantage which history can derive from more profound geographic studies, and the proportions such studies ought always to observe: "Our history obeys a sort of logic, which brings out certain geographical aptitudes but subordinates others and holds them in the background. These latter then remain without effect, or, oftener, are expressed by passing signs" (p. 382). See also the example given at the end of the preceding paragraph from the historian Ferrero: The transformations of cultivation in Italy. See finally C. Vallaux, "L'Évolution de la vie rurale en Basse-Bretagne," *Ann. de géog.*, 1905, pp. 36–51, etc.

a situation that meant more danger, but more power. Roskilde, with the old cathedral with its tall twin towers (which has been more than once rebuilt and restored, but which dates from the eleventh century), is the dead city of the royal tombs; of the 100,000 inhabitants it once had, it has not now 10,000. Copenhagen is a "half million" city, whose port is constantly growing. Would the 10,000 steamships and the 8,000 sailing vessels which annually enter the port of the present capital of Denmark ever have been able or willing to make their way to the peaceful extremity of the long fjord of Roskilde, too sheltered and too peaceful for modern commercial activity?

Between the constant natural factor and the variable human factor the relation is continually changing. It is even possible that with time the relation has become almost the opposite of what it was in the beginning.

Upon the shores of the Mediterranean and in the countries which form the Mediterranean world, in Asia Minor, Greece, Italy, Provence, Spain, the houses are hardly ever isolated and scattered. They are grouped in small villages or small cities and often around a rock more or less steep, crowned with an acropolis (Figs. 67 and 68). The village itself is in some cases perched upon the rocky eminence, which thus appears from a distance as if having a battlement of habitations. That is the fact to be observed first in its many and very different manifestations. Let us suppose this study finished and let us seek to connect this fact with human activity. What is the reason of it? And what are the human consequences of it? In order to answer these questions we shall be obliged not only to call in historic, economic, or social facts, but especially to appeal to psychological facts. If the men of the Mediterranean world grouped themselves in small cities well situated for defense, it was because the inhabitants of the cultivated territories were, so to speak, caught between the nomads and plunderers of the interior—the shepherds of the mountainous and dry back country, herdsmen of the great migrating flocks and the nomads and plunderers of the sea, professional pirates. Thence comes this collective psychological tendency to choose

for a permanent place of habitation a locality with strongholds —hills—which would serve both as good posts of observation and as good posts for defense.

It is through this psychological element, conscious with some, imitative, traditional, and very vague with others, that the explanation of this type of old Mediterranean agglomeration must be approached. In order to satisfy the sometimes contradictory demands of those primary needs which we noted in the beginning, man consciously or unconsciously obeys an instinct, a thought, a fear—psychological elements which vary from individual to individual, from group to group, and especially from epoch to epoch—so that he adopts a certain material solution and creates a certain fact of human geography. The natural setting remaining the same serves successively for contradictory human facts according to the impulses which led the inhabitants. If these inhabitants are especially interested in their defense, they elect to install themselves upon rocky heights; but if another psychological fact is stronger than this one, if the fear of being plundered disappears, if it gives place to the desire of having the best food possible or of growing rich as quickly as possible, men come down from their mountain and establish themselves either near a quarry or a mine, or nearer their fields or their gardens, in the lower and richer alluvial lands, or upon the more fertile slopes.

More than that, another fact of human geography grows up. The road, which was formerly the sea itself, the common and natural highway of all the coasting trade, takes on other forms; it becomes the railroad running along the more level parts of the coast and never ascending the isolated hills. The road—which does not "create" the "social type," whatever may be said on this point[1]—expresses and at the same time strengthens this psychological tendency, which urges men to a better comprehension and exploitation of the means of communication. And while the old Mediterranean city remains perched near its acropolis or upon the ruins of its acropolis, a new city is

[1]See Edmond Demolin, *Comment la route crée le type social*, 2 vols., Paris, new edition 1901–3.

growing near the railway station in direct contact with the road.[1]

The human psychological element is, then, at the origin of the geographical fact, the necessary intermediary between man and nature, and might be called according to a general expression dear to Henri Bergson "the direction of attention"; and it is once more a psychological factor which is found to be the necessary intermediary between man and nature in respect to the social, historical, and political consequences which are the result of it. From these houses gathered in villages or cities, from this drawing together, this crowding of inhabitants, arise habits of city life, of civic and social life, and doubtless also a certain "political" temperament.

To use the happy terms of P. Vidal de la Blache, man "long a faithful disciple of the soil" has worked so well to establish connections "between scattered features" and to substitute "for the incoherent effects of local circumstances" a "systematic concourse of forces," that he has succeeded in creating novelties upon the surface of our planet. When one has cleared away a homogeneous forest zone to cover this space with cultivation, new relations have been established which have conferred a new value and a new influence upon the physical and chemical qualities of the soil. Then another period may succeed the first one, that is an industrial period, during which overpopulation will tend to make a certain number of inequalities disappear and to cover the varied differences of the ancient agricultural zone with an almost uniform layer of human activity. The soil is thus at the mercy of man.

[1]Moreover, this fact has been reproduced several times in the course of history, or, rather, in the course of those successive histories that constitute, in the too simple and perhaps too regular phrase, Mediterranean history. Even Thucydides wrote: "The newly founded cities, having a greater experience of the sea besides more riches, established themselves on the banks or across isthmuses, for the greater convenience of their commerce. But the old cities, *αἱ δὲ παλαιαί*, because of the piracy that flourished in the old days, were built instead far from the sea, in the islands as well as on the continent" (Thucydides I, 6). See, in the work of Bérard, *Les Phéniciens et l'Odyssée*, the succession of the capitals of Argos, and the vicissitudes of some of the cities, such as Syracuse. Jacques Flach has very well emphasized, in his turn, the vicissitudes of the cities of another region, in his memoir already quoted, *L'Origine historique de l'habitation et des lieux habités* (he relates, as a type, the history of Chartres, pp. 50 ff.). He speaks of *avulsion* (uprooting) as opposed to *alluvion* (deposition), and of the migration of cities and villages, under the impetus of a tragic occurrence (p. 68). See finally what is said above of the "descent" of Bergamo toward the plain, toward the market place, and toward the railroad station, p. 173.

The rôle played by civilization in explaining the contrasts in the density of population is primordial. Between Java and Borneo, between India and Indo-China, what differences! At the time of the Khmer civilization Cambodia must have been much more populated than it is to-day.

The city is preëminently the "projection" of a collective mass of human wills. An ancient abbey becomes a manufacturing city.[1]

Commercial peoples, Phoenicians, Greeks, Venetians, Hanseatics, are essentially urban peoples (*Städtevölker*).[2] A city has in it an essential element, a market. An ancient market has often contained a city in embryo; and often also the arrangement of a bazaar or of a market, the distribution of a group of bazaars, have shaped the city, past, present, or future. But it is especially the political capitals which show that the city is always more or less an historic product of human art. It is thus (rather than by the word "artificial," which may cause confusion) that we prefer to translate the idea of Ratzel: "Eine Weltstadt ist das künstliche Produkt der Geschichte."

States are also works of human art which are dependent upon the soil and which in a certain measure stamp their image upon it. As has been wisely and wittily said, "The difference between facts of conquest and facts of destruction is often only a good police and a government interested in safeguarding riches of the future."[3] These collective wills set their mark upon the soil through cities and roads, cultivation and factories, etc.; they also set their mark upon it in the way of frontiers.

Here might be introduced a critical study of facts of limits: natural limits or conventional limits, which, by the very fact that they have been decreed as administrative or political frontiers, become points or strips of concentration for human beings and cities (strongholds, intrenched camps, or simple twin custom houses, which are brought near together by being placed opposite each other), or, on the contrary, they elsewhere

[1] See the example of Saint-Gall, in Switzerland, in C. Vallaux, *Géographie sociale, Le Sol et l'état*, p. 334.

[2] See Ratzel, *Anthropogeographie*, II, p. 503.

[3] See, on the capitals and political cities, Chapter IX of C. Vallaux, *op. cit.*

determine zones which are avoided, marked often by minima of population.[1]

How many foolish statements have been made with regard to frontiers called "natural" or "artificial"! And if we do not take account of the absurdities how many truths that are only approximate!

In order to make clear what we wish to point out, let us choose once more a specific example, illustrated in the map, Fig. 222.

In the central plateau of France are great provinces covered by and formed of volcanic rocks; the most important are Auvergne (with its dismantled massifs of the Cantal and of Mont Dore, with its younger and better preserved chain of the Puys), and on the other hand, Velay. These eruptive regions are surrounded by very different zones (See Fig. 1, p. 20) and clearly separated from each other. Now it is rather curious to discover that in the course of historical ages, a certain number of administrative, political, and religious frontiers have brought together under one jurisdiction these natural provinces of a certain similarity. The sketch, Fig. 222, shows two of these divisions taken as types twelve centuries apart: one (1) represents the part given to Childebert II in 587 by the treaty of Andelot, and this frontier line is all the more interesting because it followed the limits of ancient *civitates* and of ancient ecclesiastical divisions; the other (2) shows us that in 1789 the ecclesiastical divisions still attached on the north to the archbishopric of Bourges these different volcanic regions; Velay was joined to Auvergne, but it was separated from Forez, and Auvergne was separated from Limagne.

All this is as precise as it is ingenious. But what becomes of this subtle scaffolding, if we now consider the volcanoes of Limagne so well studied by Ph. Glangeaud? What should

[1]On the subject of the relations between natural boundaries and political boundaries (correspondence or contradictions), see F. Ratzel, "Über allgemeine Eigenschaften der geographischen Grenzen und über die politische Grenze," *Berichte der König. Sachs. Gesellschaft der Wissenschaften*, February 6, 1892, pp. 53–104. The author speaks of line-boundaries and of zone-boundaries; see the representation of the zone-boundary between Wadai and Darfur, p. 90. First of all, naturally, the *Politische Geographie* by Ratzel should be consulted, as well as the chapter by C. Vallaux to which we shall soon refer, and Chapter VII, "Geographical Boundaries," in the work by E. C. Semple already quoted.

have been explained is why a certain community or similarity of facts of human geography had led Auvergne and Velay to join together in the field of human geography.

If we should analyze all the facts claimed as typical of

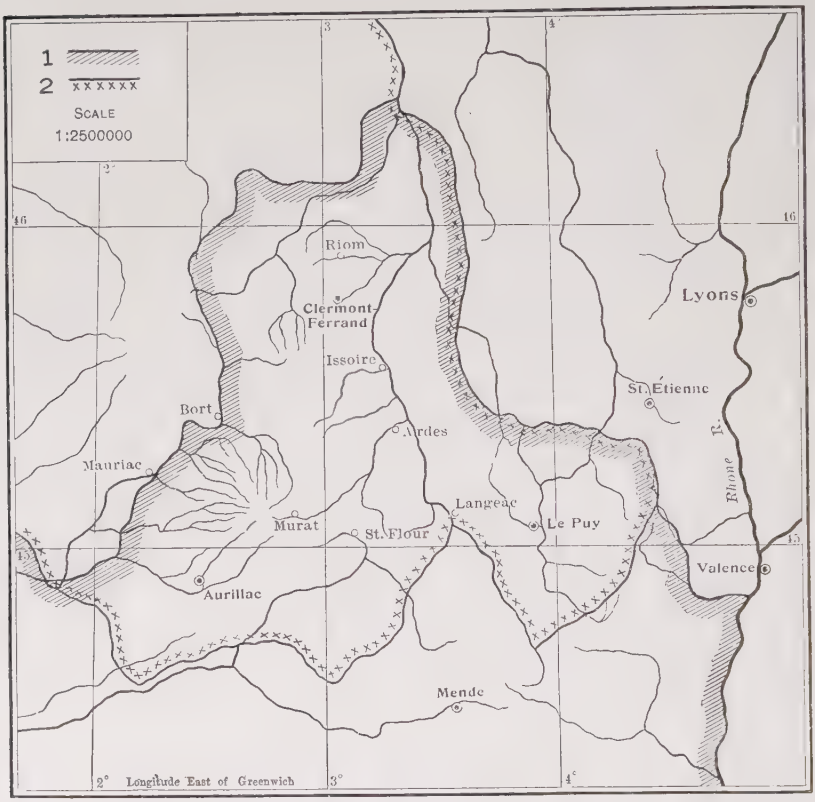


FIG. 222. ADMINISTRATIVE LIMITS WHICH HAVE REUNITED THE ERUPTIVE REGIONS OF CENTRAL FRANCE AND CONNECTED VELAY WITH AUVERGNE, OMITTING NEIGHBORING REGIONS IMPORTANT BUT QUITE DIFFERENT, SUCH AS THE PLAIN OF LIMAGNE AND THE MOUNTAINS OF FOREZ

1. Northern limit of the portion assigned to Childebert II in 587 by the pact of Andelot.

2. Southern limit of the Archbishopric of Bourges, in 1789.

natural frontiers, we should find most often pleasing analogies such as this one, but no real explanatory reasons.

In connection with the book by Augustin Bernard, *Les confins Algéro-Marocains*, a book in which the relativity of

an Algerian-Moroccan frontier is shown, Professor Brunhes wrote:

The Rhine and the Rhone, which for centuries have often been, in certain parts of their courses, such important limits of empires, are no longer so to-day; on the other hand, our frontiers often pass across mountains, zigzagging to follow the capricious line of watersheds, while in other times and in other parts of the earth mountainous massifs form true ethnic or political wholes having, in conformity with real geography, a certain autonomy. Finally, to what a relative extent is the shore of the sea a frontier? The activity of dwellers on the shore always spreads over the near-by zones of the sea, and is it not the sea, the sea alone, which caused the political grouping of the Phoenician world, of the Greek world, and even, although to a less degree, of the Roman world? There is no need, I think, to recall here the part played by the sea in certain great contemporary political empires of the Far West and of the Far East.

Are there then frontiers in nature besides the limits which are rigorously imposed upon the expansion of human life as a whole? Are there true frontiers between human groups? We find in the facts of physical geography only the natural demarcations that we seek there. I mean that a certain point becomes a true limit only according to the mode of occupation of the neighboring regions and according to the idea that has been formed at different periods and in different historic societies of the demands of a frontier.[1]

Certainly all this can and must be connected with human geography. But although the connection is very real, by what slender and subtle psychological threads is all that which we have called "social geography" and "historical geography" connected with the essential data of human geography! That is why we cannot too often repeat the constant appeals for restraint and critical prudence which we have already made. The power and means which man has at his disposal are limited and he meets in nature bounds which he cannot cross. Human activity can within certain limits vary its play and its movement; but it cannot do away with its environment; it can often modify it, but it can never suppress it, and will always be conditioned by it.

How *influencing* geographical conditions express themselves in the world of human facts is what human geography must investigate and explain in all its chapters.

The densest population in all Europe is that of Belgium,

[1] *La Géographie*, XXIII, 1911, p. 363.

which supports over 7,500,000 inhabitants upon 11,373 square miles (29,455 square kilometers), or 655 inhabitants per square mile (253 per square kilometer). Vital necessities then imply the opening of new outlets for the restless and overflowing activity of these crowded masses of human beings; and desires which have turned them toward expansion deserve to be considered as the result of a just feeling for the influence of these general conditions.

On a territory of less than 30,000 square kilometers (11,373 square miles), writes Léon Hennebicq, professor at the new University of Brussels, a cluster of dense hamlets, dwells a tenacious people. Through the vicissitudes of centuries, thanks to its rare vitality, it has managed to survive. From a little more than 3,000,000 souls eighty years ago, it has increased to nearly 8,000,000. It is one of the most populous corners, one of the busiest hives of the globe.

This impulse which finds expression in an extraordinary industrial energy is due to the strength of the populations of the south, the Walloons. To them belongs the glory of this national renewal. The whole Belgian state rests upon the robust shoulders of their workmen. Their skill and their intelligence first supplied their immediate neighbors. Then the circle of their customers grew larger and, since customs barriers closed to them the great markets of Europe, they had to turn to exportation beyond the sea or else perish. At the present moment, a watchful king having given them a fine colony, they are face to face with that imperialism of trade which dominates the life of every people that wishes to become a world power.

But the Walloon provinces do not touch upon the sea, and in the estuaries dwell the Flemish. These latter have unfortunately never wished to recognize any maritime profits except those of distribution. At Bruges in the fifteenth century, at Antwerp in the sixteenth, they did not dare, any more than to-day, to abandon the prudently profitable rôle of the middleman for the bolder career of the great ship-owner, and immediate profits have always tempted their realistic minds more deeply than has the eventual and complex building up of businesses with profits in the far future.

Thus economic Belgium offers the unexpected sight of a movement toward the creation of a national merchant marine and of a policy of foreign markets supported by the entire country and demanded particularly by Walloon industry eager for exportation but too often coming to grief against interests of foreign shipping defended at Antwerp by the powerful middlemen who live by its means. Certainly this antinomy which retards the expansion of Walloon production toward the sea is diminishing from day to day. Even at Antwerp active organizations, such as the *Ligue maritime*, have

aused the national fleet to make such perceptible progress that in fteen years it grew from 75,000 tons to 150,000 tons; it doubled. 3ut the interesting fact, the dominant characteristic, remains in he efforts which the industrial hinterland makes to control its ransportation beyond the seas and thus to participate in the move- ient of economic expansion through its more active instrument, avigation.[1]

Men are subject to nature in a real but indirect manner. 3ome have exaggerated this dependence, others have denied t. We have here a connection which, although in a sense igorous, has not at all the insistent fatality of the phenomena)f physical geography. Moreover, natural conditions do ıot have either a fatal or an immediate reaction upon human acts; a certain length of time is necessary. Elimination is ccomplished only in the course of time and we never know ıow many years or centuries will be required for this elimina- ion. The tyrannic will of a master or the obstinate clinging o routine by an ignorant people may introduce and maintain or a certain time a poorly adapted mode of life, an abnormal)rganization.

From the point of view of their influence upon man, geo- graphical facts must be grouped in a way, entirely different rom the point of view of pure physical geography. Geographi- al criticism is not content with observing facts in themselves. t must distinguish the natural and general psychological effect that these facts produce upon men, upon men obey- ng certain instinctive or traditional suggestions, seeking the satisfaction of certain needs, whether primary and necessary)r factitious. It must never forget that facts of human geography find neither their complete explanation nor their)nly principle of coördination in geographical causes alone: *'he psychological influence of geographical causes upon the human)eing, in proportion to his own appetites, needs, or whims*—this s the subtle and complex factor that must prevail in every study of human geography: the factor that permits the listribution and coördination of the facts both in relation to he natural causes and in relation to man.

Many geographers, after speaking, not without reason, of he action and reaction of natural forces and human forces,

[1] "L'Expansion maritime," *Rev. écon. internat.*, March 15–20, 1911, pp. 443–444.

then ask themselves too rigorously and abstractly: How far do natural forces exert an influence upon human activity and to what extent does man react to these forces? Some add: Would it not be well to begin by separating the effects of the first influence from the effects of the second? And would it not be well then to adopt, as principles of a general scientific division, these two antithetical terms: "action of nature upon man" and "reaction or action of man upon nature"? Thence have arisen the expressions "passive or static human geography" and "active or dynamic human geography."

Even in the most elementary facts we distinguish, on the contrary, an action and a reaction indissolubly intermingled. The man who crouches at night in a natural cave profits by a natural circumstance and the part he plays toward physical nature is reduced to a minimum. However, it is not the cave alone that is a human geographical fact, but the cave as a human refuge. Even when man does not create or modify at all the fact by which he profits, the mere fact that he profits by it gives rise to a complex phenomenon in which man, it is true, is influenced by the suggestion of nature, but in which he shares, were it only by a sort of very obscure instinct. The water course which man uses when he travels in a canoe or floats his timber acquires a place in human geography only because the river has become a road, so to speak, through man's will. Thus the most rudimentary manifestations of our terrestrial activity show the close solidarity of the human geography wrongly called passive and the human geography called, likewise wrongly, active or dynamic.

Man is never completely passive, or rather, he is entirely passive only when the agents of the physical world take his life. Earthquakes at Lisbon, San Francisco, Messina, or in Provence, cyclones in Bengal, Madagascar, or Tahiti, eruptions in Guatemala or Martinique, deadly fires or explosions of gases in the deep galleries of Courrières, all bear witness to that omnipotence of natural forces in relation to human life. First of all, it is not death but life, the conditions and manifestations of life, that are the subject of human geography. Now, so long as man lives, he acts and reacts; he drinks, he

overwhelms and paralyzes it is events that are abnormal or at least unexpected.

A temperature of five degrees below zero C (+23° F) is more terrible for the Neapolitans who live in houses that cannot be heated, than twenty degrees below zero C (−4° F) for the inhabitants of Switzerland who are accustomed to the cold of winter and ready to protect themselves from it. New York is in the same latitude as Naples, but the average temperature in winter is about 30° F (27° C). Notwithstanding the low temperature, however, the people of New York, who are in general well fed and warmly clothed, suffer little or not at all, while the cold finds many victims among the inhabitants of southern Italy, badly fed, insufficiently clothed, and poorly lodged.

There are countries like those of western Europe where the freezing of the canals and water courses completely stops traffic during the winter; it is the terrible period of the suspension of work. The boats and barges remain tied up in the small river ports—the holds empty and the little decks deserted. On the other hand, there are other countries where the freezing of the streams is such a normal and regular geographical fact that it is awaited not only fearlessly but eagerly. It is with the freezing of the rivers of northern Russia, of the Ural and of Siberia that human activity begins again. Circulation and transportation begin once more over those great white roads, now smooth and solid, which run, broad and open, through interminable forests of firs, pines, and birches.

It is well known how the hardy and laborious peoples of the Alps eagerly await the snow in order to bring down their hay or wood. On the other hand, when there is a sudden and abnormal snowfall in a region unaccustomed to it, when Paris is suddenly buried in snow as it was for the last three days of December, 1908, all traffic is interrupted.

One should not be astonished at this confusion caused in the regular and ordinary life by phenomena which are in these places unusual. One must have seen the composure—due [illegible]ver to a certain resigned indifference—the stubborn and [illegible] impassible composure, with which the inhabitants of [illegible]pes of Mount Etna or Vesuvius sometimes watch the

gradual advance of the flow of burning lava which will perhaps in a few hours bury their houses and their fields, one must have seen these men and women wait until the last moment and then withdraw step by step before the smoking stream and the consuming cloud, in order never again to charge with timidity, cowardice, or mere clumsiness other peoples or other men even among those who pass for the most fatalistic.

What consternation a flood produces among ourselves! Against fire we have at least the resource of water. But against rising and overflowing water, against this abnormal rising tide carrying along trees and wreckage which become instruments of destruction for houses and bridges, against this scourge of inundation, what can human energy do? When the phenomenon comes unexpectedly, as irregular as it is fatal, nothing can be done. When it is a river ordinarily peaceable and regular, like the Seine, which suddenly rises 26 feet (8 meters), as happened at Paris in January, 1910,[1] human energy is caught off its guard. But when the phenomenon is chronic and when men have studied it and have become acquainted with it, they can foresee it and in a certain measure fortify themselves against it. The wonderful dike-work of the upper Rhone, an honor to nineteenth-century Switzerland, is one of the most eloquent witnesses to the power of humanity over natural forces. Men have not done away with the floods of the Rhone, but they have forstalled and to a certain extent mastered them.

In a different geographical environment, the flood, being not an exceptional and disconcerting occurrence, but a normal, annual, periodic phenomenon, is counted on to such an extent by the dwellers along the rivers that the absence or insufficiency of the rising and overflowing water is the scourge and is considered by all as a catastrophe.

The life of Egypt from the earliest times has been arranged in its smallest details of cultivation and human establishment not merely in spite of, but in expectation of, the rise of the Nile. The flood is still a real flood with its violence and its dangers but it is so closely associated with all the creative and agricultural economy of Egypt that the inhabitants not only take

[1] Maximum rise of the Seine, Jan., 1910, 27 ft. 7 in. (8 m. 42) at the Tournelle bridge.

account of it but they discount it, and their fear is lest the Nile remain in its bed and the periodic flood of muddy water should not rise high enough to submerge their fields.

Thus everything on the surface of the globe is for men a matter of habit, of sound understanding of physical facts, and of skillful adaptation to these facts. Moreover, the adaptation must take place promptly and at the right time—preceded, prepared for, and brought about by exact scientific investigations.

These investigations should also tend to moderate our ambitions, to turn us away sometimes from undertakings that would mean such bold opposition to the forces of nature that man would run the risk of seeing sooner or later his patient work annihilated at a single stroke. The more imposing and glorious man's conquest, the more cruel the revenge of the thwarted physical facts. A natural effect, such as the sinking of drained marshes because of the very draining, is sufficient to destroy the whole enterprise. In the neighborhood of Aquileia, marshy lagoons had been reclaimed; 4,000 acres of land were under cultivation; but this drained land sank and was again overflowed by the sea.[1]

When men have succeeded in raising dikes that shut in the Po or the Hwang-Ho, when they have pushed back the North Sea and won the polders of the Netherlands, the more fruitful their efforts, the greater the risk they run. An invasion of water from the sea or an exceptional flood in these rivers is destructive in direct proportion to the natural forces that have been victoriously overcome.[2] In January, 1910, at the time of the flood that has just been mentioned, the Seine, shut into a too narrow bed at Paris between vertical walls, took a disastrous revenge.

Before modifying the course of an overflowing river there is need of ripe reflection and a calculation of all the consequences that may be produced downstream as well as upstream. If its course is narrowed at one point, not only must it be deepened at that point but also much farther downstream; in addition the banks must be raised not merely at the point of narrowing but much farther upstream.

[1] See E. Suess, *La Face de la terre*, English translation by Sollas, Vol. II, pp. 420, 421.

[2] On the subject of Hwang-ho, which is always Nih-ho—that is to say, the River Incorrigible—see pp. 211 ff., of Elisée and Onésime Reclus, *L'Empire du milieu* (with a bibliography by H. Froidevaux), Hachette, Paris, 1902.

If its course is shortened by the substitution of a more direct path for the windings, the speed of the water is increased so that often its banks cannot resist the current, to say nothing of the fact that deposits appear downstream in the form of shallows or even islands if there is a slight diminution of the speed of the current as a result of a broadening of the river, of a bend, or of a less-inclined bed.[1]

In building great reservoir dams upon torrential water courses in Spain and Algeria for purposes of irrigation, critical situations were caused in the irrigated regions after those sudden "water bolts" which carried away very fine works of masonry.

It is better to content one's self with a half victory over natural agents rather than to expose one's self to defeats which are catastrophes; this should be one of the wise rules of geographical adaptation.[2]

It is likewise in a sense a forcing of natural conditions to extend too far the cultivation of any plant and cause an excess of production. The number of mouths and stomachs in the world that are fitted to receive coffee or wine is limited; neither the total number nor the capacity of individuals can be suddenly modified. Furthermore, in the regulation of the demands of consumption a most important part is played by the psychological factor—taste, fashion, habit, tradition—which is the true master, a master whose power takes different forms but which in its changing, manifold, and scattered manifestations exercises on the whole an inexorable tyranny.

Certainly the total current consumption changes with almost inconceivable rapidity. To-day in remote districts of our countries the peasant eats or drinks, almost every day, coffee, tea, chocolate, beet sugar, and potatoes, all products that but two centuries ago were either luxuries or entirely unknown. He is so accustomed to these foods and drinks that it is difficult for him to realize their very recent novelty. This proves aptitude for a new education, the great power

[1] See, for example, in Jean Brunhes, *L'Irrigation*, p. 52, "Tableau récapitulatif des barrages-réservoirs de l'Algérie" (*barrages actuels et barrages détruits*). Also, R. M. Brown, "The Movement of Load in Streams of Variable Flow," *Bull. Amer. Geog. Soc.*, XXXIX, 1907, pp. 147–158; "The effect of Levees on the Height of the River Bed," *ibid.*, XLVI, 1914, pp. 596–601.

[2] A. Woeikof has shown, by a series of ingenious examples, taken especially from Russian countries, to what an extent our civilization is "unharmonious"; for our works are carried on contrary to a wise economy of the earth, and often pave the way for, or increase the disastrous power of, natural agents; see "De l'Influence de l'homme sur la terre," *Ann. de Géog.*, March 15, 1901; read especially pp. 100–102.

that a movement of opinion may exercise upon usages that are the most elementary and that would seem the most ineradicable, the possible docility of the consumer. It does not diminish in any respect the immediate import of the consideration that must be fundamental at a given moment of economic evolution — that the capacities of consumption have their maxima and its demands have limits which any wise and reasonable exploitation of the earth must not go beyond.

If it does go beyond them, the result is poverty. An overabundant wine harvest in the south of France or an overabundant coffee harvest in the Brazilian state of São Paulo may become a worse calamity than any scarcity. Now, because of the possible world consumption in these times of what we have often called "the civilization of circulation," the great temptation of every region of the earth is monoculture. There is a seemingly great demand for a certain product from all points of the globe. This is concentrated upon each small producing zone and the inhabitants are seized with the idea that they alone can and must meet this exceptional demand. Since this psychological fact causing increased production occurs everywhere, an over-satisfaction of the demand results and — partially, geographically — an overproduction of products that can no longer be consumed.

How can adaptation to human geographical conditions be brought about?

Everywhere there appears a tendency to regulate production (a tendency that we have carefully noted in those small worlds of unstable equilibrium, the irrigated oases). This becomes a political duty of governments at a time of crisis. In the presence of the overproduction of coffee, which, after having made the fortune of the state of São Paulo, threatened its business and its credit with a total financial collapse, the Brazilian government went into the business of monopolization of its chief product in order to sell the excess product gradually in foreign markets. Moreover it strictly forbade any new plantations within its territory. This operation was called the "valorization of coffee."[1] Other states, impelled by like

[1] Max Turmann explained clearly this operation of the "valorization" of Brazilian coffee, in an article in the *Rev. hebdomadaire* (August 28, 1909, pp. 450–470), which he has reprinted in his book *Problèmes économiques et sociaux*, Lecoffre, Paris, 1910.

difficulties, seek a remedy in other ways; e.g., the agreement between the Greeks and the Paris union for the buying of the entire harvest of raisins, whatever it may be.[1]

Finally, everywhere there are developing unions and *cartells* of producers. We cannot study here their different types of organization nor their good or bad effects, but they lead to a limiting regulation of production and often to a distribution of markets among the members.

In a preceding paragraph we used the expression "unstable equilibrium," and we can speak of a more and more unstable equilibrium in the present economic world. As a result of the progress in means of transportation a famine is no longer to be feared in a well-equipped country (that is, equipped in proportion to its population). But other dangers threaten us, such as not only a local but a general overproduction of certain products, causing underselling, and that means lack of employment and the paralysis of labor, a situation which is only another form of famine. Here it is in reality a question of overflows of human products; they must be foreseen and provided against in advance; the flood of production must never be made to pass between banks of consumption that are too low. Here again we feel that vast solidarity of the life of the world, and the economists, those "engineers" of human facts, must more and more discover and teach the laws—if there are any—of geographic adaptation.

Is it not, at least in part, an illusion to believe that by increasing his means of control and conquest of the earth man throws off its tyranny and increases his own independence? Is it not, on the contrary, a sort of contract with more exact and one might almost say more Draconian terms that is signed by civilized men as they make their relations with the earth closer and more productive?[2]

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[1] A. Andréadés, "Une Nouvelle Expérience économique: la crise de surproduction des raisins de Corinthe et la Société privilégiée," *Rev. écon. internat.*, April 15–20, 1909, pp. 130–152. This is the plan proposed by the Greek financier Jean Pesmazaglou, which was adopted by the Chamber in 1905 under the energetic influence of minister Rhallys. The name of the society is Société privilégiée pour la production et du commerce du raisin de Corinthe or Héniaia. Let us mention also the type of international solution which the International Sugar Convention of Brussels represents; see p. 283.

[2] These ideas are in accordance with the ideas of Alfred Hettner in the observations on general human geography which he has given at the beginning of his *Grundzüge der Länderkunde*, I Bd., *Europa*, Leipzig, 1907. In an interesting memoir, "Le Tellurisme

Cultivation with the plow, or *Ackerbau*, seems to free us or at least to detach us somewhat from the soil to which we are closely bound with the spade or hoe, which latter method of cultivation Eduard Hahn calls *Hackbau* and which we might call cultivation by hand. But the careful cultivation in which and for which men, with bent bodies, wield the main tool with their hands is not merely the labor of Fang women nor of the natives of the Pacific islands who cultivate taro, nor even of the Chinese or Javanese who transplant their rice; it is also the work of the practiced market-gardeners of the suburbs of Paris or Brussels, it is the perfected work of all horticulturists. Where cultivation reaches the highest degree of intensity, in those chosen spots near the centers of a highly developed civilization, it seems that human muscles must get ever closer to the fertile mold and that in very truth the earth must be touched, handled, and, as it were, kneaded by the hands of men.

In the Congo forest, where there is no domestic animal, all transportation is on the backs of men, just as in the high mountains of Austria, Italy, Switzerland, or France men and women carry on their backs enormous loads of hay to the *fenili* or to the *mayens*. Now what becomes of transportation in the intense economic life of our largest industrial cities? If there are tribes of "porters" in the Congo, are there not innumerable groups of "porters" in the warehouses of London or Hamburg and in the railroad stations of Paris or New York? The Congo carriers are obliged to make long trips from one post to another through the forest, while the "dockers," the *débardeurs*, or the *Träger* of our civilized cities must make over and over again a shorter trip—always nearly the same—from the landing-dock to the trucks or from the loading-dock to the coal bunkers; but they cover more miles daily than the

social," *Rev. internat. de sociol.*, 1900, Émile Worms, emphasizing and commenting on the importance given by Ratzel to the soil as the foundation of the state, says: "Without doubt the number of human beings is increasing, but the soil which they inhabit and which is the enforced theater of their activity will remain the same. This soil, then, is obliged to yield harvests for men and to bear fruits in an ever-increasing quantity, a fact which tends to make it ever more sought after and to increase its value. This results in relations constantly closer between the people and the soil, and the significance of the soil in and for the state becomes more and more obvious." The chief memoir by Ratzel here discussed is undoubtedly, *Der Staat und sein Boden geographisch betrachtet* (*Abhandlungen der philologisch. hist. Classe der Königl. Sächsischen Ges. der Wissenschaften*, XVII, 1896, No. 4, 127 pages and 5 drawings).

African blacks. They must bend their necks and backs beneath the crushing weight of sacks of grain, bales of cotton, beams of iron, huge trunks, etc., instead of keeping the erectness of living caryatids (Fig. 223); far from having loads limited to 50 or 75 pounds (25 or 30 kilograms) like those of the negroes, they must often handle and carry more than 225 pounds (100 kilograms).[1]

Does not all *Verkehrskultur*, all "civilization of circulation," such as ours increase the number of persons engaged in transportation as well as the total weight of the merchandise carried by the strength of our fellow men? May we not say that nearly all the materials, raw or manufactured, which feed the system of world trade must, at least for a few moments, be lifted by human muscles? All progress that adds to the amount and rapidity of economic exchange literally bears down with a heavier and heavier weight upon the shoulders of ever larger groups of our fellow men.

Is it not then an illusion to believe that where the masses of most advanced humanity are found and where the geographic evidences of the means or methods of the most complicated economic activity, factories, railroads, telegraph and telephone lines, etc., are most numerous, the most elementary and brutish forms of human labor are suppressed or at least ameliorated?

Is it not another illusion to believe that the accumulation of human beings, and therefore of human forces, upon the same points of the earth must bear witness to a greater mastery over the earth? Is not a city like Paris more strongly bound to its site than ancient Paris—the old city of Lutetia—or than those ephemeral villages of dried mud in the valley of the Nile which we have described above? Has Paris not

[1] In France the minister of labor obtained the passage of a bill, dated December 28, 1909, fixing the limit of the loads which may be carried, dragged, or pushed, either by children under eighteen years of age or by women of every age employed in the following establishments: manufactories, mills, foundries, lumber or coal yards, workshops, laboratories, etc.:

Carrying of loads.— Boys or men; under fourteen years, 22 pounds (10 kilos); fourteen or fifteen years, 33 pounds (15 kilos); sixteen or seventeen years, 44 pounds (20 kilos); Girls or women: under fourteen years, 11 pounds (5 kilos); fourteen or fifteen years, 17 pounds (8 kilos); sixteen or seventeen years, 22 pounds (10 kilos); eighteen years and over, 55 pounds (25 kilos), etc.

This excellent innovation was made because of great abuses. It goes without saying that no minister of labor in a European or an American state would dare to undertake to regulate the maximum loads which may be carried by the adult man.

been made so dependent by necessities of food and of economic life that the slightest interruption of normal traffic would become a catastrophe? Do not masses of human

Jean Brunhes

FIG. 223. HOW MOST SEMI-CIVILIZED OR PRIMITIVE PEOPLE DO THEIR CARRYING

This scene is on the trail from Wadi Halfa to Khartum. The Nubian is moving and carries all her household goods on her head.

beings such as those of India foil all efforts that can be made to feed them when once the wheat or rice happens to fail and the reign of hunger begins?

A nation, a province, and a city are great and fragile masterpieces of human geography. Their equilibrium is unstable to the very extent to which men have increased the number of their unavoidable daily connections with the natural environment. The necessity of maintaining this equilibrium at any cost strengthens the bonds that attach a given group to a given place. How much suffering, how many efforts and years are required for a small town to change its form and place, for one of those modest Mediterranean cities to tear

itself from the rocky mound of its acropolis and draw near to the railroad station! If, on the other hand, this bond that attaches men in groups to a portion of the surface of the globe happens to be suddenly broken, not by man himself but by the earth, days and months do not suffice to reëstablish it. Can it ever be reëstablished as it was? The earthquake of December 28, 1908, destroyed Messina. The victims were not only the dead but the living. They were completely and disastrously cut off from those small points of the earth's crust where their lives were organized, where they had adapted themselves to the ever-recurring demands of eating, sleeping and clothing. And more than that, their psychical life, their intellectual, civic and social life was bound and anchored to those material facts which are the outgrowth of the city, the houses and streets of that Messina that had disappeared. Workshops, meeting-places, titles and values, state archives, etc., all that was tangible, were destroyed and at the same time those beings who survived became, so to speak, anonymous, with no authentic social label. They were, in the strictest sense of the word, uprooted, and because their substratum of urban geography had been annihilated, they all resembled more or less that class of orphan children whose exact age it has been impossible to ascertain, and whose family or name cannot be discovered.

Individual man has a power of movement which has increased more than a hundred fold in the last century, but this facility of movement of individuals should not blind us to the relative but real fixity with which human groups and masses are rooted to the soil. A group is uprooted only under the irresistible impulse of a crisis of death, poverty or hunger. The inhabitants of an Alpine village, driven out by an avalanche, by a landslide, by fire, or by economic ruin, may to a certain extent move and emigrate, while on the morrow of a catastrophe San Francisco or Messina must remain almost fatally bound to its original site or its immediate neighborhood. Each individual inhabitant of London or Berlin is at perfect liberty to take the train any day and leave the city. But it is none the less certain that the population of those cities as a whole, if it wishes to continue to eat and to have

shelter, is, as a mass, irrevocably forced to remain at the place where it is.

As human forces are increased and concentrated, it is true that the fine shades of difference between human efforts and human geography become fainter or disappear; they vanish in spots of more homogeneous and harsher color. But it must not be thought, for that reason, that man's dependency upon natural conditions has been eliminated; it is merely different. And fundamental geographical facts are becoming more and more the sovereign masters of men. These facts which tend to influence more and more the destinies of human groups, these tyrannical factors of the human geography of to-morrow are: (*a*) space; (*b*) distance; (*c*) difference of level.

Space, i.e., surface not only occupied but able to be occupied, is a boon which is indisputably the basis not only of every great city but of every powerful collective being. Modern states fight with each other to win space. The decided advantage of the United States comes from the immense space that it covers. All the struggles for imperialism are struggles for space. Ratzel has strongly emphasized the value of this geographical fact and we wish here only to call to mind the thoughtful significance that he has given to it.[1] Likewise the population stifles in all the great cities of the Old and the New World and the birth-rate decreases because space is lacking, because a large number of beings are deprived of the indispensable minimum of "a place in the sun and on the earth." Is it not after all a minimum of space that is the

[1]Even in 1893, Schrader rightly noted the geographic importance of dimension in the question of general geography (*Rev. de l'école d'anthropologie*, 1893, p. 214). Ratzel's last memoir on space is the following: "Der Lebensraum, Eine biogeographische Studie," from *Festgaben für Albert Schäffle zur siebzigsten Wiederkehr seines Geburtstages*, Tübingen, 1901, pp. 103–189. Note also two previous memoirs: "Studien über politische Räume," *Geog. Zeitschr*, I, 1895, pp. 163–182 and 286–302; "Die Gesetze des räumlichen Wachstums der Staaten, ein Beitrag zur wissenschaftlichen politischen Geographie," *Petermanns Mitt.*, XLII, 1896, pp. 97–107. Ratzel seems, however, somewhat to exaggerate the importance of the rôle of space. Nations of small extent still count for much in the life of humanity, and it is not completely demonstrated that "the extent of states increases with civilization." On the other hand, how accurate it is to emphasize what we might call the crude participation of a factor like space in the growing power of the United States, and how worth while it is to mention that the five enormous political aggregates, the United States, Brazil, the British Empire, China, and pre-war Russia, covered almost half of the politically usable earth! See above, p. 229, the real meaning that one ought to attribute to space. See, above all, the excellent criticisms put forward by C. Vallaux against Ratzel's conception of "space in itself," in *Géographie sociale, Le sol et l'état*, Chapter, V, pp. 145 ff.

expressive foundation, the geographic mark and guaranty of the first and inalienable right of every human being, the right to life?

Distance means an obstacle to be overcome, an obstacle that is measured by time. In economic relations in the midst of a reign of civilization based upon traffic, time is the other standard of wealth and power. Let the reader recall, from the point of view of distance crossed and the necessary results in human facts, the vicissitudes of the very recent struggles between Spain and the United States, between England and the Transvaal, between Russia and Japan. What a numerical superiority of human beings would have been or was required to make up for and overcome, in these different cases, the inferiority resulting from the thousands of miles which for the Spanish, the English, and the Russians separated the theater of war from their base of operations!

In the strictly geographical field there is the well-known competition between rival railroad companies to establish the shortest line, for, in the large majority of cases, it is simply the number of miles that determines the path of merchandise.[1]

Finally, *difference of level* allows gravity to act upon water, a form of economic wealth, a measure of available power. It is a new wealth, or rather a potential wealth, which hitherto has expressed itself negatively by a real inferiority in the economic struggle to the account of populations installed at high altitudes and which is seen to-day as representing gratuitous advantages that nothing can rival or replace.

All this is the consequence of the efforts of men and of the significance which, by their labor, they have given to these natural facts—facts as old as the world, but facts whose

[1]For a work on botanical geography showing very well the natural part played by distance in the dissemination and in the migration of plants, and consequently in the actual composition of the Alpine vegetal carpet, see the study which one of my pupils made under the direction of the professor of botany at Geneva, Chodat: Renato Pampanini, "Essai sur la géographie botanique des Alpes et en particulier des Alpes sud-orientales," thesis of Fribourg, published in the *Mémoires de la Soc. fribourgeoise des Sciences naturelles, série: "Géologie et Géographie,"* Vol. III, 1903; see especially p. 204. For examples of the part played by distance in human problems of communication, we refer to our numerous publications on the Simplon, on the means of access to the Simplon, on the Gotthard and the Simplon, etc., particularly "Gotthard et Simplon," *Rev. des deux mondes,* November 15, 1909, pp. 373–395.

interpretation and utilization are new and even revolutionary because of, and in proportion to, human ingenuity and intelligence.

Space, distance, and difference of level become in fact geographic values, because men conquer them and make them serve their needs. Now, how does this domination show itself if not — once more and always — by the building of factories and fortresses, of roads, of canals, or of railroad stations, by the creation and maintenance of fields and gardens, of transport animals or herds, by the exploitation of the natural vegetal carpet or of mineral riches? Space, distance, difference of level are conditions and factors of human work and settlement; let us never confound them with the forms of this work, with the material marks of this settlement. They are means more or less propitious or contrary to life, wealth, or power; they are not the direct ends pursued by individuals, tribes, or nations. They are in themselves only pure natural geography; they exercise an influence and find a place in the geography of man only if they are, as it were, "animated" by man's spirit and mingled with our lives. Does not that mean that they must find expression in some of the six types of facts that have been pointed out and described? By this path we arrive at the same main conclusion: Physical phenomena, like human phenomena, rightly find a place in human geography only in so far as they are connected with the actual surface phenomena which are included within one of the three groups of unproductive occupation of the soil, of plant and animal conquest, or of destructive exploitation.

The essential facts are not all of human geography, but all human geography is rigorously in direct relation with one or more of the essential facts. Very evidently everything in the essential facts is far from being explicable by geography alone. Nevertheless everything that forms a part of the essential facts becomes for that very reason an observable geographical reality.

It is thus that even those imponderable and immaterial factors which make the life of societies, which make manners and customs, history and civilization, are translated into geographic terms.

Every people, every human settlement covers the surface of the earth with those outward and visible signs which reveal its presence, reflect its manner of being and its power of action, and allow us to divine its past, and sometimes even its future.

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